

DOCUMENT 000100 - PROJECT DIRECTORY

Landscape Architecture	Hargreaves Jones 180 Varick Street, Suite 204 New York, NY 10014
Architecture	Sage & Coombe Architects 12-16 Vestry St, 5th Floor New York, NY 10013
Acoustic/Theater/AV	OAP P.C. 77 Water Street New York NY 10015
Civil, Structural, and Geotechnical Engineering	Stewart 421 Fayetteville St., Suite 400 Raleigh, NC 27601
Environmental Engineering	Soil & Environmental Consultants, PA 8412 Falls of Neuse Road, Suite 104 Raleigh, NC 27615 Eagle Resources P.O. Box 11189 Southport, NC 28461
Lighting Design	Tillotson Design Associates 40 Worth Street, Room 703 New York NY 10013
Irrigation	Clark Irrigation Design & Consulting, Inc P.O. Box 693 Lavonia, GA 30553
Mechanical, Electrical, Plumbing, and Fire Protection	Cheatham & Associates, PA 3412 Enterprise Drive Wilmington NC 28405
Marine Structural Engineering	Andrew Consulting Engineers 3811 Peachtree Avenue, Suite 300 Wilmington, NC 28403
Soil Design	Landis, PLLC 3908 Bentley Brook Dr. Raleigh, NC 27612
Specifications	The Friday Group 88 Mainelli Road, Suite 2 Middlebury, VT 05753

Water Fountain Design

Commercial Aquatic Engineering
6500 Carlson Drive
Eden Prairie, MN 55346

Wayfinding

TWO TWELVE
236 W 27th Street, Suite 802
New York NY 10001

END OF DOCUMENT

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<u>Consultants Key:</u>		
<i>Author</i>	<i>Firm</i>	<i>Discipline</i>
CT	Clancy & Theys	Construction Manager
HJ	Hargreaves Jones	Prime / Landscape Architecture
ACE	Andrews Consulting Engineers	Sub / Marine Structural Engineering
CH	Cheatham	Sub / MEP, Fire Protection
CI	Clark Irrigation	Sub / Irrigation Design
DF	Delta Fountains	Sub / Water Fountain Design
LP	Landis	Sub / Soil Engineering
OAP	OAP	Sub / Audiovisual Design
SCA	Sage + Coombe Architects	Sub / Architecture
ST-C	Stewart	Sub / Civil Engineering
ST-S	Stewart	Sub / Structural Engineering

PROCUREMENT AND CONTRACTING REQUIREMENTS

INTRODUCTORY INFORMATION

Document 000000	Procurement and Contracting Requirements	CT	12/04/19
Document 000100	Project Directory	SCA	12/04/19
Document 000111	Table Of Contents	SCA	12/04/19
Document 001000	Solicitation	CT	12/04/19
Document 002000	Instructions for Procurement	CT	12/04/19
Document 003000	Available Information	CT	12/04/19
Document 004000	Procurement Forms and Supplements	CT	12/04/19
Document 005000	Contracting Forms and Supplements	CT	12/04/19
Document 006000	Project Forms	CT	12/04/19
Document 007000	Conditions of the Contract	CT	12/04/19

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Section 011400	Special Inspections	ST-S	12/04/19
Section 012300	Alternates	HJ	12/04/19
Section 012305	Architectural Alternates	SCA	12/04/19
Section 012500	Substitution Procedures	HJ	12/04/19
Section 012600	Contract Modification Procedures	HJ	12/04/19
Section 013100	Project Management and Coordination	HJ	12/04/19
Section 013200	Construction Progress Documentation	HJ	12/04/19
Section 013233	Photographic Documentation	HJ	12/04/19
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Section 013300	Submittal Procedures	HJ	12/04/19
Section 014000	Quality Requirements	HJ	12/04/19
Section 014200	References	HJ	12/04/19
Section 014339	Architectural Mockups	SCA	12/04/19
Section 014533	Structural Testing and Special Inspections	ST-S	12/04/19
Section 015000	Temporary Facilities and Controls	HJ	12/04/19

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Section 016000	Product Requirements	HJ	12/04/19
Section 017300	Execution	HJ	12/04/19
Section 017329	Architectural Cutting and Patching	SCA	12/04/19
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SECTION 011110 - SUMMARY OF ARCHITECTURAL WORK

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section addresses:
 - 1. Project Description.
 - 2. Related Documents.
 - 3. Codes, Regulations, Authorities.
 - 4. Owner's Environmental Requirements.
 - 5. Specification And Drawing Conventions.
 - 6. Definitions.
 - 7. Industry Standards.
 - 8. Existing Utilities.
 - 9. Owner-Furnished Products.
 - 10. Objections To Application Of Products.
 - 11. General Installation Provisions.

1.2 PROJECT DESCRIPTION

- A. Project Identification:
 - 1. Project Name: North Waterfront Park
 - 2. Project Location: North Waterfront Park, Wilmington, NC.
 - 3. Architect: Sage and Coombe Architects.
- B. Project Summary: Work includes an outdoor stage structure and a variety of support structures totaling approximately 18,000 Square feet. The components of the project are as follows:
 - 1. Stage and Loading Dock: Previously Issued.
 - 2. Stage Building: Brick and ground face block structure containing offices, storage, dressing rooms, showers, restrooms, with an outdoor terrace.
 - 3. Park Support Building and Canopy: Brick structures containing offices, restrooms, box office, and catering, with alternate freestanding steel/wood/glass canopy over both buildings.

1.3 RELATED DOCUMENTS

- A. The Contract Documents are complementary, and what is required by one shall be as binding as if required by all.

- B. Conflicts or discrepancies among the Contract Documents are resolved in following order of priority:
 - 1. Change Orders and other Modifications, in reverse chronological order;
 - 2. Agreement between Owner and Contractor;
 - 3. The Specifications;
 - 4. The Drawings;
 - 5. Other Contract Documents incorporated by reference in the Agreement Between Owner and Contractor.

1.4 CODES, REGULATIONS, AUTHORITIES

- A. Comply with all applicable codes, ordinances, regulations and requirements of all authorities having jurisdiction (AHJ).
- B. Submit copies of each permit, license, certification, inspection report, release, notice, judgment, and communication from authorities having jurisdiction (AHJ) to the Architect.
- C. Comply with laws, ordinances, rules, regulations and lawful orders as required and in conformance with Contract Documents. Keep building department, fire department, and other authorities completely informed of changes in the work in a timely manner. This includes contract modifications, amendments, additions, shop drawings, and the like, current as of Project Manual date.
- D. Gain approvals as required for Owner occupancy within contract scheduling requirements.
- E. Make adjustments and modifications as required to conform to ordinances, and regulations.
- F. Compliance Requirements:
 - 1. Referenced codes establish minimum requirement levels. Where provisions of various codes or standards conflict, the more stringent provisions govern. Promptly submit to Architect written notice of observed contract document variations from legal requirements.
 - 2. Specifications of Higher Standards: Drawings and Specifications govern whenever Drawings and Specifications require higher standards than are required by governing codes, regulations, and the like.

1.5 OWNER'S ENVIRONMENTAL REQUIREMENTS

- A. Approach and construct project in an environmentally sensitive manner, focusing on the following general goals:
 - 1. Ensure good indoor air quality (IAQ) during construction.
 - 2. Support reduced future maintenance and operation costs.
 - 3. Ensure reduced energy use and cost during construction.
 - 4. Reduce primary and secondary usage of fossil fuels and other Greenhouse gasses

during construction.

5. Ensure reduced water usage during construction and facilitate minimizing planned overall annual facility water usage.
6. Give added decision-tree weight to minimizing life-cycle costs and overall embodied energy of systems, products and materials incorporated into the project.
7. Manage demolition, sitework and construction to minimize waste, promote salvaged reuse, recycling or energy conversion, and specifically minimize amounts sent to landfills.
8. Take preventative measures to reduce or eliminate environmental pollution and damage during construction.
9. Facilitate achieving requirements for federal, state and local rebates, and other incentive programs.
10. Maintain a smoke-free workplace by implementing and enforcing a no-smoking policy at the worksite for all people onsite, including, but not limited to, workers, visitors, and delivery personnel.

1.6 SPECIFICATION AND DRAWING CONVENTIONS

- A. The Project Manual (the Specifications) is part of the Contract Documents between Owner and Contractor and is therefore written addressing the Contractor. Although references to subcontractors are made occasionally, it is not the intent of the Project Manual to divide the work into subcontracts; this is the responsibility of the Contractor.
- B. Specification Format: The Specifications are organized into Divisions and Sections using the 48 Division format using the CSI/ CSC's "MasterFormat 2004" numbering system.
 1. Section Identification: The Specifications use Section numbers and titles to help cross-referencing in the Contract Documents. Sections in the Project Manual are in numeric sequence; however, the sequence is incomplete because all available Section numbers are not used. Consult the table of contents at the beginning of the Project Manual to determine numbers and names of Sections in the Contract Documents.
 2. Division 01: Sections in Division 01 - GENERAL REQUIREMENTS, govern the execution of the Work of all Sections in the Specifications.
- C. 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. Abbreviated Language: Language used in the Specifications and other Contract Documents is abbreviated. Words and meanings shall be interpreted as appropriate. Words implied, but not stated, shall be inferred as the sense requires. Singular words shall be interpreted as plural, and plural words shall be interpreted as singular where applicable as the context of the Contract Documents indicates.
 2. Imperative mood and streamlined language are generally used in the Specifications. Requirements expressed in the imperative mood are to be performed by Contractor. Occasionally, the indicative or subjunctive mood may be used in the Section Text for clarity to describe responsibilities that must be fulfilled indirectly by Contractor or by

others when so noted.

- a. 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.
- b. The word "provide" means to "supply and install."
3. Architectural/Engineering Abbreviations: See Drawings.
4. Interpret singular words plurally and plural words singularly wherever applicable and full context of requirements implies.
5. Pages are numbered separately for each section. Each section is noted with "END OF SECTION" to indicate when section is complete.
6. Number of Specified Items Required: Wherever in these Specifications an article, device or piece of equipment is referred to in the singular number, the reference applies to as many such articles as are shown on the Drawings or required to complete the installation.
7. Tense, Gender, Singular, Plural: Present tense words include future tense. Words in masculine gender include feminine and neuter genders. Words in the singular include plural. Plural words include singular.
8. Specification by Reference: Materials and products specified by reference or number, symbol or title of a specified standard, such as commercial standard, ANSI and ASTM documents, Federal Specifications, trade association standard, or the like, shall comply with the following:
 - a. The latest revision requirements thereof with amendments or supplements thereto in effect on date of Project Manual, except as modified;
 - b. When building code requirements refer to a different issue of standards specifications, such issue governs; and
 - c. Listing of certain reference standards: Refer to Section 014200 - REFERENCE STANDARDS.

D. Intent of Drawings:

1. Drawings are in part diagrammatic and do not necessarily show complete details of construction, work or materials, performance or installation. They do not necessarily show how construction details, other items or work, fixtures, and equipment may affect any particular installation. Ascertain and correlate the work to bring the parts together into a satisfactory and completed whole.
2. Drawings do not show exact characteristics of the work, piping and air distribution configurations, or necessary number of fittings. The Drawings indicate only such details as are necessary to give a comprehensive ideal of the Work. In order to illustrate the Work, the Architect may furnish additional Drawings, explanations and clarifications consistent with the original Drawings, purpose and intent of the Contract. Conform Work to such Drawings and explanations. The furnishing of such additional Drawings, explanations or clarifications is for the convenience of the Contractor and shall not entitle the Contractor to an increase in the Contract time or Contract Sum.
3. Furnish and install work not covered under any heading, Section, branch, class or trade of the Project Manual, but shown on or reasonably inferable from the Drawings. This includes work necessary to produce the intended results.
4. Do not scale drawings. Dimensional accuracy is not guaranteed, and field

verification of dimensions, locations, and levels to suit field conditions is required.

- E. 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 as scheduled on Drawings.
 3. Keynoting: Materials and products are identified by reference keynotes referencing Specification Section numbers found in this Project Manual.

1.7 DEFINITIONS

A. General Definitions:

1. A(a)cccepted, A(a)ccceptance or A(a)ccceptable: Materials, components, equipment and installations accepted by the Architect shall be based upon Inspections (as defined below).
2. AHJ: "Authorities Having Jurisdiction" over the project site including construction materials, assemblies, means and methods.
3. And: Conjunction indicating that items in series are to be taken jointly. It may also mean plus or in addition to preceding items in series.
4. Approved: Where used in conjunction with Architect's response or action, meaning will be held to limitations of Architect's responsibilities and duties as specified in General and Supplementary Conditions. In no case will Architect's approval be interpreted as release of Contractor from responsibilities to fulfill requirements of Contract Documents.
5. Concealed And Concealed Space: Embedded within construction, in trenches, in crawl space, space between finish ceiling and structure above; space between double walls and furred in areas.
6. Custom Color: Color selected by Architect not limited to manufacturer's standard colors or other color designations. Custom Color: Any color selected by Architect.
7. Day: Except as otherwise defined in Owner-Contractor Agreement, day means calendar day.
8. Directed, Requested: Terms such as "directed," "requested," "authorized," "selected," "approved," "required," "accepted," and "permitted" mean "directed by Architect," "requested by Architect," and similar phrases. However, no such implied meaning shall be interpreted to extend Architect's responsibility into area of construction supervision.
9. Exposed To Public View: Not installed underground or "concealed" as above and in spaces other than building equipment and maintenance spaces which are not normally accessible by or open to users of facility.
10. Exposed: Not installed underground or "concealed" as above.
11. Finish: Manner or method of completion. Final appearance of surface, including texture, smoothness, sheen, and color, after finishing operations have been

- performed. Finishing operations include preparation of substrate and application, curing, and protection of specified finish materials.
12. **Furnish:** Supply, purchase, procure and deliver complete with related accessories, ready for assembly, application, installation, and similar operations, as applicable in each instance.
 13. **Indicated:** Refers to graphic representations, notes, or schedules on Drawings, or other paragraphs or Schedules in Specifications, and similar requirements in Contract Documents. Terms such as "shown," "noted," "scheduled," and "specified" are used to help reader locate reference. Location is not limited.
 14. **Install:** Unload, temporarily store, unpack, construct, assemble, erect, mount, anchor, place, connect, apply, finish, cure, protect, clean, and similar operations, complete with related accessories, as applicable in each instance.
 15. **Installer:** The person or firm engaged by Contractor or Subcontractor for performance of a specific unit of installation work at the project site. It is a general requirement that Installers be expert and experienced in the work they are engaged to perform.
 16. **Observe, Observation:** Except as otherwise defined in greater detail, the Architect's observation of the work will be held to the limitations stated in the General and Supplementary Conditions and the Owner/ Architect Agreement. In no case shall observation by the Architect be interpreted as a release of Contractor of his responsibilities to fulfill all of the requirements of the Contract Documents. Observe shall be defined in accordance with the General Conditions of the Contract to include only visiting the site periodically, observing the condition and progress of the work, and reporting to the Owner.
 - a. **Or:** Introduce any of possibilities in series. Items in series are not required to be taken jointly. It does not mean that individual items in series are optional requirement
 - b. **Product:** Includes natural and manufactured materials, components, machinery, fixtures, equipment, devices, furnishings, systems, and their associated accessories to be incorporated into Work.
 - c. **Project Site:** The space available for performing construction activities, either exclusively or in conjunction with others performing other work as part of the Project. The extent of the Project site is shown on the Drawings and may or may not be identical with the description of the land on which the Project is to be built.
 - d. **Provide:** Furnish and install, complete and ready for operations and use for purpose intend
 - e. **Regulations:** Includes laws, ordinances, statutes, and lawful orders issued by Authorities Having Jurisdiction, as well as rules, conventions, and agreements within the construction industry that control performance of the Work.
 - f. **Similar:** Interpreted in its general sense and not as meaning identical. Coordinate elements defined as "similar" in relationship to their location and connection with other parts of Work.
 - g. **Testing Agency:** An independent entity engaged to perform specific inspections or tests, either at the Project site or elsewhere, and to report on and/ or interpret results of those inspections or tests.
 - h. The term "experienced", when used with the term Installer means having a

minimum of five previous projects similar in size and scope to this Project, being familiar with the special requirements indicated, and having complied with requirements of the authority with jurisdiction.

17. True To Line, Plumb, Level, And Flat: If other tolerances are not specified or indicated, install Work within following tolerances:
- a. True To Line: Allowed deviation from straight line.
 - b. Plumb: Allowed deviation from vertical plane.
 - c. Level: Allowed deviation from horizontal plane.
 - d. Flat: Allowed deviation from flat plane in any planar direction.
 - e. Allowed Deviation: Within plus or minus 5mm in one meter; plus or minus 3mm in 3 meters; plus or minus 6mm in 6 meters; and plus or minus 9mm in lengths over 6 meters.
 - f. Tolerances are not cumulative.

1.8 INDUSTRY STANDARDS

- A. Referenced standards are part of the Contract Documents and have the same force and effect as if bound with these Specification Sections.
- B. Except where specifically indicated otherwise, comply with the current standard in effect as of the date of the Owner/ Contractor Agreement.
- C. Obtain copies of industry standards directly from publisher.

1.9 EXISTING UTILITIES

- A. Utilities of record are shown on the Reference Drawings insofar as possible or practical to do so. These, however are shown for convenience only and the Owner and Owner's representatives assume no responsibility for improper locations or failure to show utility locations on the Drawings.
 1. Coordinate with applicable utility agencies to verify utility locations, and observe "Call Before You Dig" requirements. Immediately repair utilities damaged during construction, and pay all costs for damages to properly identified utilities.
 2. Coordinate interruption of utilities with the Owner.

1.10 OWNER-FURNISHED PRODUCTS

- A. General: Certain items, designated on the Drawings by the abbreviations "FOIC," "FOIO" and "NIC" often require blocking, backing and accessory items necessary to complete the installations. This blocking, backing and accessory items for complete installations are requirements of this project as further defined below.
 1. Owner will arrange for and deliver Shop Drawings, Product Data, and Samples to Contractor.
 2. Owner will arrange and pay for delivery of Owner-furnished items according to Contractor's Construction Schedule.

3. After delivery, Owner will inspect delivered items for damage. Contractor shall be present for and assist in Owner's inspections.
 4. If Owner-furnished items are damaged, defective, or missing, Owner will arrange for replacement.
 5. Owner will arrange for manufacturer's field services and for delivery of manufacturer's warranties to Contractor.
 6. Owner will furnish Contractor the earliest possible delivery date for Owner-furnished products. Using Owner-furnished earliest possible delivery dates, Contractor shall designate delivery dates of Owner-furnished items in Contractor's Construction Schedule.
 7. Contractor shall review Shop Drawings, Product Data, and Samples and return them to Architect noting discrepancies or anticipated problems in use of product.
 8. Contractor is responsible for receiving, unloading, and handling Owner-furnished items at Project site.
 9. Contractor is responsible for protecting Owner-furnished items from damage during storage and handling, including damage from exposure to the elements.
 10. If Owner-furnished items are damaged as a result of Contractor's operations, Contractor shall repair or replace them.
- B. Certain items, designated on the Drawings by the abbreviation "FOIC" means furnished by Owner, installed by Contractor. Items for installation by the Contractor will be furnished to the job site for consignment to the Contractor. Owner shall assume responsibility for delivery in accordance with the construction schedule, obtaining installation drawings and arranging for guarantees and warranties. Designate required delivery dates and assume responsibility for newly delivered items upon uncrating and determining that the contents are complete and in satisfactory condition for installation. Installation for Owner furnished items includes delivery to installation location, installation of manufacturer's recommended backing, setting in place, building-in, leveling and attaching to walls, floors and/or ceilings, making mechanical or electrical connections and leaving items completely installed and in operable condition satisfactory to Owner and Architect.
1. Owner's Representative is responsible for providing the Contractor required information for coordination when requested. Items not specifically listed or described herein are to be provided and installed by the Contractor as part of the base project and included in the same.
 2. FOIC Items: Refer to individual Sections.
- C. Items designated by the Drawings by the abbreviations "FOIO" meaning "Furnished and Installed by Owner," will be furnished and installed by the Owner.
1. Provide blocking and any other necessary work required prior to actual installation. Confirm with Owner work to be done such as blocking or cut outs.
 2. FOIO Items: Refer to individual Sections.

1.11 OBJECTIONS TO APPLICATION OF PRODUCTS

- A. Contractor and Subcontractors for this Project are required to thoroughly familiarize

themselves with specified products and installation procedures prior to start of work and submit to Architect any objections to specified products or installation procedures, or any conflicts between manufacturers' installation instructions and contract defined installation procedures (in writing) not later than 10 days prior to start of work. Start of work constitutes acceptance of products and procedures specified.

1.12 GENERAL INSTALLATION PROVISIONS

- A. General: Provide all items, articles, materials, and operations listed, including labor, materials, equipment and incidentals required for their completion.
 - 1. Prior to installing an item or material, verify that receiving surfaces are plumb, level, true to line, and straight to the degree necessary to achieve tolerances specified or required. Perform without extra cost shimming, blocking, grinding, or patching required to make such surfaces plumb, level, true to line and straight.
 - 2. Take care in attention to details and fitting at intersections and junctures of materials. Joints are to be tight, straight, even, and smooth.
- B. Fastening and Connections: Furnish fastenings and connections necessary and adequate to assemble work whether indicated or not. Function:
 - 1. Contractor is responsible for proper assemblage and intended performance of all components and assemblies; bonds to bond properly, fastening to fasten properly; operable items to operate smooth, without sticking or binding, and without "play" or looseness; and the like.
 - 2. Where deemed necessary to establish conformance with these requirements, inspection and testing by an independent testing laboratory may be required as indicated in Section 014529 - TESTING LABORATORY SERVICES.
- C. Presence of Architect or Owner: Do not misconstrue presence of this person or any of Architect's/Owner's representatives at the site as assuring compliance with Contract Documents.
- D. Installer's Inspection of Conditions:
 - 1. Require the installer of each major unit of work to inspect the substrate to receive work and conditions under which the work is to be performed.
 - 2. The installer shall report unsatisfactory conditions in writing to the Contractor.
 - 3. Do not proceed with the work until unsatisfactory conditions have been corrected in a manner acceptable to the installer. Start of work constitutes acceptance of substrates.
- E. Inspection of Items to Be Installed:
 - 1. Inspect each item of materials or equipment immediately prior to installation.
 - 2. Reject damaged and defective items.
- F. Attachment and Connection:
 - 1. Provide attachment and connection devices and methods for securing work. Secure

- work true to line and level, and within recognized industry tolerances. Allow for expansion and building movement.
2. Provide uniform joint width in exposed work. Arrange joints in exposed work as drawn or to obtain the best visual effect. Refer questionable visual-effect choices to the Architect for final decision.
- G. Measurements: Check measurements and dimensions of the work, as an integral step of starting each installation.
- H. Dimensions and Measurements on Drawings:
1. Dimensions govern.
 2. Do not scale.
 3. Check dimensions in the field and verify them with respect to adjacent or incorporated work. Large scale drawings take precedence over smaller scale drawings, plans, elevations, and cross sections.
 - a. Information concerning existing conditions was considered suitable for preparation of the Drawings and is given for Contractor's *convenience*. Architect and Owner does not guarantee accuracy of such conditions. *Field verify, as per above.*
- I. Weather Conditions:
1. Install each unit of work during weather conditions and project status which will ensure the best possible results in coordination with the entire work.
 2. Isolate each unit of finished work and protect as necessary to prevent deterioration.
 3. Inspection and Tests: Coordinate enclosure of the work with required inspections and tests, so as to minimize the necessity of uncovering work for that purpose.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION (NOT USED)

END OF SECTION

SECTION 01 1400 SPECIAL INSPECTIONS

PART 1 GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary General Conditions and other Division I Specification Sections, apply to this Section.
- B. Refer to individual technical specification sections for specific qualifications, inspections, tests, frequency and standards required.

1.2 GENERAL REQUIREMENTS

- A. Special Inspections shall be in accordance with Chapter 17 of the North Carolina State Building Code.
- B. The program of Special Inspection is a system intended to ensure that the work is performed in accordance with the Contract Documents. These services do not relieve the Contractor and/or the Construction Manager of responsibility for compliance with the requirements of the Contract Documents.
- C. This specification section is intended to inform the Contractor and/or the Construction Manager of the Owner's Special Inspection program and the extent of the responsibilities. This specification section is also intended to notify the Special Inspector, Testing Company/Testing Laboratory, and other Agents of the Special Inspector of their requirements and responsibilities.
- D. Perform inspections in accordance with industry standard referenced for specific material or procedure unless other criteria are specified. In the absence of a referenced standard, perform inspections in accordance with generally accepted industry standards.
- E. Failure to detect defective work or materials shall in no way prevent later rejection if defective work or materials are discovered.

1.3 SCHEDULE OF SPECIAL INSPECTIONS

- A. Required Special Inspections are described in the attached Statement of Special Inspections.

1.4 DEFINITIONS

- A. Testing: Evaluation of systems, primarily requiring physical manipulation and analysis of materials, in accordance with approved standards.
- B. Inspection: Evaluation of systems, primarily requiring observation and judgment.
- C. Special Inspection: Special Inspection herein includes items required by the current State Building Code, and other items which in the professional judgment of the Structural Engineer of Record, are critical to the integrity of the building structure.
- D. Structural Engineer of Record (SER): The Licensed Engineer in responsible charge of the structural design for the project.
- E. Testing Agency (TA):
 - 1. Testing Agency: Approved independent materials testing agency acceptable to the Owner, Architect, and SER.

- F. Special Inspector (SI): A licensed professional engineer responsible for administering and performing all Special Inspections required by the Statement of Special Inspections.
- G. Agents of Special Inspection (AI): Individual inspectors performing specific Special Inspections on behalf of the Special Inspector.
- H. Building Official: The Officer or duly authorized representative charged with the administration and enforcement of the State Building Code.

1.5 QUALIFICATIONS

- A. The Special Inspector shall be a licensed Professional Engineer (licensed in state in which project is located) experienced with the type of work requiring Special Inspections, who is approved by the Owner, Structural Engineer of Record (SER) and Building Official.
- B. Required inspector's qualifications for the Special Inspector and Agents of the Special Inspector are described in the attached Statement of Special Inspection.

1.6 SUBMITTALS

- A. The Special Inspector shall submit to the Owner for review a copy of their qualifications which shall include the names and qualifications of each of the agents of Special Inspection who will be performing inspections.

1.7 PAYMENT

- A. The Owner shall engage and pay for the services of the Special Inspector and Agents of the Special Inspector.
- B. The Contractor and/or Construction Manager shall be responsible for the cost of any re-inspection of work which fails to comply with the requirements of the Contract Documents.

1.8 RESPONSIBILITIES/AUTHORITY

- A. Special Inspection:
 - 1. Special Inspector and Agents of Special Inspections:
 - a. Sign the Statement of Special Inspection in conjunction with other responsible parties prior to commencing construction.
 - b. Inspect the work assigned for conformance with the contract documents and applicable material and workmanship provisions of the code. Perform inspection in a timely manner to avoid delay of work.
 - c. Bring nonconforming items to the immediate attention of the Contractor and/or Construction Manager for correction, then, if uncorrected after a reasonable period of time, to the attention of the Structural Engineer of Record, the Building Official, and to the Owner.
 - d. Submit inspection reports to the Contractor and/or Construction Manager, the Structural Engineer of Record, Owner, and other designated persons in accordance with the Statement of Special Inspection.
 - e. Submit a final signed report stating whether the work requiring Special Inspection was, to the best of the Special Inspector's knowledge, in conformance with the contract documents and the applicable workmanship provisions of the code.
 - 2. Architect:
 - a. Expedite resolution of construction issues.
 - 3. Structural Engineer of Record:

- a. Identify items requiring Special Inspection and define qualifications of special inspector required for work.
- b. Prepare and sign the Statement of Special Inspection in conjunction with other responsible parties prior to commencing construction.
- c. Review reports issued by Special Inspector.
- d. Assist in resolution of construction issues identified by Special Inspector.
4. Testing Agency:
 - a. When engaged as a special inspector, provide Special Inspection services as noted in Item 1.8.A.1.
 - b. Copy Special Inspector on all materials testing reports.
5. Contractor/Construction Manager:
 - a. Arrange and attend all pre-construction meetings to review scope of Special Inspection. Include the Building Official, Owner, Architect, Structural Engineer of Record, Special Inspector, Testing Agency and other parties concerned.
 - b. Post or make available the Statement of Special Inspection within the project site office. Provide timely notification to those parties designated on the schedule so they may properly prepare for and schedule their work.
 - c. Provide special inspector access to the approved plans and specifications at the project site.
 - d. Review all reports issued by special inspector.
 - e. Retain at the project site all reports submitted by the special inspector for review by the building official upon request.
 - f. Correct, in a timely manner, deficiencies identified in inspection reports.
 - g. Provide safe access to the work requiring inspection.
 - h. Provide labor and facilities to provide access to the work and to facilitate inspection.
 - i. Sign the Contractor's Statement of Responsibility, if required, prior to commencing construction.
6. Fabricator/Supplier:
 - a. Submit one copy of all material certificates and other quality assurance documents as required in the Statement of Special Inspections to the Special Inspector.
7. Building Official:
 - a. Accept and sign completed Statement of Special Inspection.
 - b. Review the final report submitted by special inspector.
 - c. Determine work, which, in the Building Officials opinion, involves unusual hazards or conditions (IBC 1704.13 – Special Cases).
8. Owner:
 - a. Provide and pay cost of Special Inspection services.
 - b. Provide special inspector with Contract Documents and accepted shop drawings.
 - c. Provide special inspector with full access to the site at all times.
 - d. Sign the Statement of Special Inspection in conjunction with other responsible parties prior to commencing construction.

1.9 INSPECTION NOTES

- A. Contractor and/or Construction Manager provide minimum of 24 hours notice for all items requiring inspection. Do not construct items requiring inspection services until testing and inspection services are available. Do not enclose or obscure items requiring inspection services until inspection services are performed.

1.10 LIMITS ON AUTHORITY

- A. The Special Inspector may not release, revoke, alter, or increase the requirements of the Contract Documents.
- B. The Special Inspector will not have control over the Contractor and/or Construction Manager means or methods of construction.

- C. The Special Inspector shall not be responsible for construction site safety.
- D. The Special Inspector has no authority to stop the work.

1.11 DAILY RECORDS AND REPORTS

- A. Detailed daily reports shall be prepared by Special Inspector and Agents of Special Inspection of each inspection and submitted to the Special Inspector. Reports shall include, but not be limited to:
 - 1. date of inspection
 - 2. name of inspector or agent
 - 3. location of specific areas inspected
 - 4. description of inspection and results
 - 5. applicable ASTM standard
 - 6. weather conditions
 - 7. identification of product and specification section
- B. Any discrepancies from the Contract Documents found during a Special Inspection shall be immediately reported to the Contractor and/or Construction Manager. If the discrepancies are not corrected, the Special Inspector shall notify the Structural Engineer of Record and Owner. Reports shall document all discrepancies identified and the corrective action taken.
- C. The Testing Company/Testing Laboratory shall immediately notify the Special Inspector of any test results which fail to comply with the requirements of the Contract Documents.

1.12 MONTHLY REPORTS

- A. Monthly reports shall be prepared by the Special Inspector. Reports shall include, but not be limited to:
 - 1. Summary of elements inspected during that month.
 - 2. Copies of all discrepancies noted during that month.
 - 3. Report of status of discrepancies including resolution of discrepancies.
 - 4. Summary of all material certifications and quality assurance documents collected and reviewed during that month.

1.13 FINAL REPORT OF SPECIAL INSPECTIONS

- A. The Final Report of Special Inspections shall be completed by the Special Inspector and submitted to the Structural Engineer of Record, Owner, Contractor and/or Construction Manager, and Building Official prior to the issuance of a Certificate of Use and Occupancy.
- B. The Final Report of Special Inspections will certify that all required inspections have been performed and will itemize any discrepancies and how those discrepancies were resolved.

PART 2 PRODUCTS (not applicable)

PART 3 EXECUTION (not applicable)

Attached are the following forms:

- 1. Contractor Statement of Responsibility
- 2. Statement of Special Inspections
- 3. Qualifications of Inspectors and Testing Technicians

END OF SECTION

SECTION 012305 - ARCHITECTURAL ALTERNATES

PART 1 - GENERAL

1.1 SUMMARY

- A. Section includes administrative and procedural requirements for alternates.
 - 1. Alternate Requirements: A Schedule of Alternates is included at the end of this Section. Each alternate is defined using abbreviated language, recognizing that the Contract Documents define the requirements. Coordinate related work to ensure that work affected by each alternate is complete and properly interfaced with work of each selected alternate.
 - 2. Provide written proposals for each alternate on the Form of Proposal for Owner's consideration. Each proposal amount shall include the entire cost of the alternate portion of the work including overhead, profit, taxes, insurance, and other costs including cost of interfacing and coordinating the alternate with related and adjacent work.
 - 3. Selection of Alternates: Selection of alternates to be included in the Work will be by the Owner. Owner may select any Alternate in any order chosen at the time of subcontract award or at any point during construction. Subcontractor shall include activities in its schedule that identifies the material release dates for each material related to an Alternate named in the Bid Form.

1.2 DEFINITIONS

- A. Alternate: An amount proposed by bidders and stated on the Bid Form for certain work defined in the bidding requirements that may be added to or deducted from the base bid amount if Owner decides to accept a corresponding change either in the amount of construction to be completed or in the products, materials, equipment, systems, or installation methods described in the Contract Documents.
 - 1. Alternates described in this Section are part of the Work only if enumerated in the Agreement.
 - 2. The cost or credit for each alternate is the net addition to or deduction from the Contract Sum to incorporate alternate into the Work. No other adjustments are made to the Contract Sum.

1.3 PROCEDURES

- A. Alternate bids may or may not be accepted by Owner, at its sole and absolute discretion, and Owner reserves the right to reinstate any Alternate bid as described in Contract Documents.
- B. Materials added or deducted by the alternate shall become part of and be governed by the provisions of the specifications section(s) for like materials and/or construction.

- C. Coordination: Revise or adjust affected adjacent work as necessary to completely integrate work of the alternate into Project.
 - 1. Include as part of each alternate, miscellaneous devices, accessory objects, and similar items incidental to or required for a complete installation whether or not indicated as part of alternate.
- D. Notification: General Contractor shall notify each party involved, in writing, of the status of each Alternate immediately following an award of the subject subcontract. Indicate if Alternates have been accepted, rejected, or deferred for later consideration. Include a complete description of negotiated revisions to Alternates.
- E. General Contractor and each Subcontractor shall execute accepted alternates under the same conditions as other Work of the Agreement.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION

3.1 SCHEDULE OF ALTERNATES

- A. Alternate No. 1: Park Support canopy and all associated structure and lighting.

END OF SECTION

SECTION 013234 - COMPUTER AIDED DESIGN COORDINATION

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes administrative provisions for coordinating construction operations on Project including, but not limited to, the following:
 - 1. Project data extraction and translation.
 - 2. Project data transmission and exchange.
 - 3. Revisions and change tracking.
 - 4. Administrative provisions for organization and use of Project data.

1.2 DEFINITIONS

- A. Contract Documents: Includes the Drawings, Specifications, and the 3-D Database.
- B. Project Data: Computer files comprised of the 3-D Database and 2-D database electronic files, and electronic documents including the Specification.
- C. 3-D Database: A set of 3-dimensional electronic CAD (Computer Aided Design) models, as well as supplemental text files such as transmittals and notes for the use of data files.
- D. 2-D Database: A set of 2-dimensional CAD (Computer Aided Design) files, as well as supplemental text files such as transmittals and notes for the use of data files.
- E. Computer Distribution Media: Data files provided on a data transfer site (FTP or similar) and may include physical distribution media.
- F. Physical Distribution Media: Data files provided by means other than data transfer site, including magnetic tapes, disks, or compact discs (CD).

1.3 PROJECT DATABASE

- A. Ownership Of Data: Project database and drawings, electronic media, electronic forms and other similar terms are subject to the Terms and Conditions for use of the Architect's documents as listed below.
 - 1. The Contractor must notify the Architect of discrepancies or conflicts between the 3-D Database and other portions of the Contract Documents to the extent they are identified.
- B. The Drawings, 3-D Database, Specifications and other Contract Documents are complementary and together define the scope, design intent, and other project requirements.

- C. The project utilizes the 3-D Database as defined in the notes and diagrams contained on the Drawings.
- D. The 3-D Database for the Project is divided into a number of individual models. All models together comprise the project master 3-D Database.
- E. The 3-D Database is not a comprehensive virtual model for the Project. Portions of the Project have been selectively modeled to provide an efficient means to describe the Project, and document the geometry for dimensional control. The 3-D Database is of limited completeness. The project utilizes the 3-D Database as defined in the complete notes contained in the Drawings.
- F. By using any such Project database, Contractor agrees to the following Terms and Conditions for Use of the Architect's Documents:
 - 1. Authorized Use Of Project Database: The Architect grants the Contractor the nonexclusive right to use the Project database in accordance with the terms of the Architect's Electronic Release Form. The 3-D Database shall be used for establishing three dimensional geometries of represented surfaces and elements and their relationship to work points established in other Contract Documents. The Contractor, their respective subcontractors, agents, or representatives shall not be entitled to rely on the detail or specifications contained in the Project database for any other purposes. The Contractor acknowledges the limited completeness of the data in the 3-D Database, that the data is intended to compliment and supplement but not necessarily supersede other Contract Documents, and understands that the 3-D Database is not complete and is not for erection or fabrication purposes in the form provided.
 - 2. Unauthorized Use Of Project Database: The Project database shall not be used by Contractor, or transferred to any other party, for use in other projects, additions to the current project, or any other purpose for which the material is not strictly intended by the Architect, without the Architect's express written permission. Any unauthorized modification or reuse of the material shall be at the Contractor's sole risk, and Contractor shall cause their Subcontractors having access to the Project database to agree to defend, indemnify, and hold the Architect harmless, from all claims, injuries, damages, losses, expenses, and attorney's fees arising out of the unauthorized modification or use of these materials. Project database as prepared by the Architect is provided solely as an instrument of the Architect's service and is protected by applicable laws and conventions. By delivering the Project database to the Contractor, the Architect shall not expand in any manner the scope of services for which it is engaged pursuant to its Agreement with the Owner, or in any manner alter the division of responsibilities between the Architect, the Contractor and the Owner as defined in their respective Agreements.
- G. Contractor's Coordination Requirements: Before using the geometry control information contained in 3-D Database for the development of Contractor's engineering and shop drawings, the Contractor shall:
 - 1. Exercising the professional skill, care and judgment which can reasonably be expected from other contractors in like circumstances, review and verify existing conditions, dimensions and coordinate with information in the Contract Documents prior to the development of shop fabrication drawings, layout drawings, numerically

- controlled fabrication equipment, or other applications which define, control, and/or regulate the fabrication and erection of any component of the Project;
2. Read and abide by any provisions contained in electronic files that may be issued with each version of Project database released by Architect.
 3. Take all reasonable measures to prevent unauthorized access to or loss of the Project database;
 4. Maintain an independent record of all modifications of the Project database which may be processed by Contractor, its Subcontractors, their employees and agents;
 5. Cause its subcontractors to be solely and exclusively responsible for the accuracy and adequacy of all subsequent data, computer models or other electronic media developed by such subcontractors. The Architect is not party to and has no control over the use of such subcontractor generated media;
 6. Take appropriate action, by way of instruction or otherwise, with its subcontractors, employees and agents who have access to the Project database, to insure compliance with these Conditions;
 7. Submit copies of Contractor or subcontractor generated data, computer models or other electronic media to the Architect for review prior to beginning fabrication operations. The Architect may review and comment on such media at its option. The information is in addition to required shop drawing submittals.
- H. Contractor also agrees to the following provisions:
1. Verify locations of critical elements during and after installation, such as connection points between different materials and systems. Report items that vary from the Contract Documents. Notify and coordinate other subcontractors that are affected by mislocated elements.
 2. Import data for control points, surfaces and lines of fabricated and installed Work into the 3-D Database, and place on separate levels as required with and by the Architect.
 3. Copy data files to the Architect at Substantial Completion of the Work.
 4. Upon the Architect's request, return original Project database and all other papers, documents, materials and other property of the Architect held by the Contractor, subcontractors, employees, and their agents in connection with the Project.
- I. Because the information stored in the Project database can be modified by other parties, intentionally or otherwise, without notice or indication of said modification, the Architect reserves the right to remove all indicia of its ownership and/or involvement in the Project database from each electronic medium not held in its possession. The Architect does not convey, nor does the Contractor obtain any right, title, or interest in the Project database or any computer programs, specifications, or data furnished or developed by the Architect.
- J. Contractor recognizes that designs, plans, and data stored on electronic media, such as computer disk and magnetic tape, may be subject to undetectable alterations or uncontrollable or undetectable deterioration. Contractor therefore agrees that the Architect shall not be liable for the completeness or accuracy of any materials provided on electronic media as caused by undetectable alterations or uncontrollable or undetectable deterioration. Project database and other Contract Documents are intended to be complementary to each other, and do not necessarily supersede

information contained elsewhere in the Contract Documents.

1.4 DATA EXTRACTION

- A. The 3-D computer database issued by the Architect is the primary source of dimensional control for complex structural steel, complex millwork geometry, structural support systems for complex millwork, railings attached to complex millwork and other components of the project as determined by the Architect. Data extraction from the 3-D Database, including all required dimensional information for these components of the work, shall be the sole responsibility of the General Contractor.
- B. Different types of data may be extracted from the Digital Project database. Use of these includes, but is not limited to:
 - 1. To establish scope of represented elements.
 - 2. As the dimensional control document for represented elements.
 - 3. As a basis for the development of field layout, coordination and fabrication drawings of represented elements.
- C. Portions of the 3-D computer database are issued for reference and informational purposes only as indicated in the Drawings. The models indicated as reference in the filename are being issued for visual reference and content only, including existing building, and new construction geometry for which dimensional control is provided through the Drawings. Information in the reference only models, are not part of the contract documents, and have no contractual relevance. Information in these files represents information to the best of the consultant's knowledge, must be verified by the contractor and used solely at the contractor's own risk. The information represented may be incomplete, may not represent actual field conditions or may be diagrammatic in nature.
- D. The Contractor is responsible for determining what data is needed and extracting that data accurately.

1.5 DATA TRANSMISSION AND EXCHANGE

- A. Project database issued to the Contractor will be distributed through the Architect's FTP site or by physical distribution media, if appropriate. The final method of delivery will be mutually agreeable to the Architect, the Contractor, and hits subcontractors. The Contractor shall distribute Project database and other Contract Documents to bidders, subcontractors and all other entities on a need to know basis through a Contractor FTP site or other means.
- B. All 3-D Database information exchanged with the Architect shall be delivered to the Architect in software format acceptable to the Architect.
- C. All 2-D information exchanged with the Architect shall be delivered to the Architect in software format acceptable to the Architect.

1.6 REVISION AND CHANGE TRACKING

- A. 3-D Database files will be tracked by date and revision numbers contained in the filename. Current revision levels shall be documented in a database format mutually agreeable to all concerned parties; if any discrepancies are found please confirm latest revision level(s) with Architect. Model objects that are new or have been revised since the previous issue will be indicated by color highlighting in the electronic files.
- B. 3-D database files issued as revisions to the contract documents will be accompanied by a written description of the changes in the model.

1.7 TRANSLATIONS

- A. The 3-D Database will be issued to the Contractor in the software format currently employed by the Architect. The Contractor shall maintain software and hardware at jobsite to read the 3-D Database in its native format.
- B. Translations of the Architect's 3-D Database into other software formats shall be the sole responsibility of the Contractor, and verification of the accuracy of the translations shall be the sole responsibility of the Contractor.
- C. 3-D Models submitted to the Architect as required by various sections of the Project Manual shall be in a format acceptable to the Architect.

1.8 CONTRACTOR RESPONSIBILITIES

- A. Contractor is the primary user and distributor of information and data contained in the Project database. Contractor has complete responsibility for determining their need for and dissemination of information to subcontractors, sub-subcontractors and vendors that may not have direct access to Project database. Contractor's responsibility may include any of the following nontraditional tasks:
 - 1. Bidding: Material takeoffs for quantity, dimensions and geometry of component elements of building for subcontractors and vendors who do not have 3-D Database use capability.
 - 2. Shop Drawings: Providing extractions and translations from Project database for use by subcontractors in preparation of shop drawings.
 - 3. Coordination: Coordinating information from subcontractors including shop drawings and product data into coordination drawings required in Division 01.
 - 4. FTP Site: Contractor shall distribute the Project database electronic data to, the Architect, subcontractors, and others through Contractor's FTP Site, physical distribution media, or other acceptable means.. The Architect will issue Contract Documents to the Contractor through the Architect's file transfer site, physical distribution media, or other acceptable means.
- B. Maintaining Data: Contractor shall maintain electronic copies of the Project database as required for record Contract Documents.

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95% CONSTRUCTION DOCUMENTS

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION (NOT USED)

END OF SECTION

SECTION 014339 - ARCHITECTURAL MOCKUPS

PART 1 - GENERAL

1.1 SUMMARY

- A. General: Provide and coordinate mock-up assemblies at Project site for Architect's review and acceptance, in accordance with requirements of the Contract Documents. Refer to individual Specification Sections for mock-up requirements.

1.2 SUBMITTALS

- A. Shop Drawings of Mock-Ups: Provide large scale shop drawings for fabrication, installation and erection of all parts of each mock-up. Provide plans, elevations, and details of anchorage, connections and accessory items.
- B. Photographs of Mock-Ups: Submit photographs of mock-ups after completion of installation and acceptance of each mock-up.
- C. Samples: Refer to individual Specification Sections for submittal requirements of mock-up components and coordinate accordingly.

1.3 QUALITY ASSURANCE

- A. Design Modifications: Make design modifications to work only as required to meet performance requirements and to coordinate the work. Indicate proposed design modifications on shop drawings. Maintain original design concept without altering profiles and alignments indicated.
- B. Mockups: Before installing portions of the Work requiring mockups, build mockups for each form of construction and finish required to comply with the following requirements, using materials indicated for the completed Work:
 - 1. Build mockups in location and of size indicated or, if not indicated, as directed by Architect.
 - 2. Assemble and erect specified items with specified attachment and anchorage devices, flashings, seals, and finishes.
 - 3. Tests, if required, will be performed under provisions identified in the respective product specification section.
 - 4. Notify Architect 7 days in advance of dates and times when mockups will be constructed.
 - 5. Demonstrate the proposed range of aesthetic effects and workmanship.
 - 6. Obtain Architect's approval of mockups before starting work, fabrication, or construction.
 - 7. Allow 7 days for initial review and each re-review of each mockup.
 - 8. Maintain mockups during construction in an undisturbed condition as a standard for

judging the completed Work.

- C. Where mock-up has been accepted by Architect and is specified in product specification sections to be removed; remove mock-up and clear area when directed to do so. Unless otherwise directed, maintain mock-ups until completion of the project. Protect mock-up from weather, damage and vandalism.
- D. Re-construct/Re-erect/Re-apply Mock-Up/Field Samples as required until accepted by Architect.
- E. Mock-ups shall remain the property of the Owner.

PART 2 - PRODUCTS

2.1 MATERIALS AND PRODUCTS

- A. Provide materials, components, and products for theater panel assembly mock-ups and for specified interior construction components as specified in individual Specification Sections.

PART 3 - EXECUTION

3.1 GENERAL

- A. Refer to PART 3, EXECUTION portions of the various Specification Sections for specific requirements regarding condition of surfaces, erection, integration with other work and erection tolerances.

3.2 MOCK-UPS

- A. Provide mock-ups of types and sizes required by individual Specification Sections to evaluate and set the standard of quality for that work. Obtain Architect's acceptance of visual qualities prior to commencing work that individual mock-up is intended to represent. Protect and maintain approved mock-ups throughout the work of the Contract. Locate mock-ups at the Project site as directed by Architect.
- B. Required Mock Ups:
 - 1. Section 042000 - UNIT MASONRY: In place mock up as indicated on the Drawings.
 - 2. Section 062013 - EXTERIOR FINISH CARPENTRY: In place mockup of steel and wood canopy as indicated on the Drawings.
 - 3. Section 072713 - SELF-ADHERING SHEET AIR BARRIER MEMBRANES: Representative of primary exterior wall assemblies and glazing assemblies including backup wall and typical penetrations, approximately 8 feet long by 8 feet
 - 4. Section 078413 - PENETRATION FIRESTOPPING: Each typical firestop system proposed for use in the project
 - 5. Section 084000 - ALUMINUM FRAMED FACADE SYSTEMS: In place mock up for Window and Door assemblies for typical wall openings

6. Section 092900 - GYPSUM BOARD: Typical drywall installation demonstrating quality of installation and finish.
7. Section 093000 - TILING: 36" x 36" section of each tile specified.
8. Section 099100 - PAINTING: Apply in field, at their final location, each type and color of approved paint materials, applied 10 feet wide, floor to ceiling of wall surfaces.

3.3 PROTECTION OF MOCK-UPS

- A. Mock-ups shall be adequately protected from damage by weather, construction personnel and construction operations until mock-ups are no longer necessary.

3.4 REMOVAL AND DISPOSAL

- A. Demolish and remove mock-ups from site at the completion of the Project. Legally dispose of demolished mock-up materials.

END OF SECTION

SECTION 017329 - ARCHITECTURAL CUTTING AND PATCHING

PART 1 - GENERAL

1.1 SUMMARY

- A. Provide cutting, fitting, and patching required to complete the Work, and to:
 - 1. Make its several parts fit together properly;
 - 2. Join new work to existing work;
 - 3. Uncover portions of the work to provide for installation of any ill-timed work;
 - 4. Remove and replace defective work;
 - 5. Remove and replace work not conforming to requirements of Contract Documents;
 - 6. Remove samples of installed work as specified for testing; and
 - 7. Provide routine penetrations of non-structural surfaces for installation of piping, duct work and electrical conduit.
- B. For additional requirements for cutting and patching, see respective specifications sections.

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 surfaces to original conditions after installation of other Work.

1.3 SUBMITTALS

- A. Cutting and Patching: Submit a method describing procedures at least 10 days before the time cutting and patching will be performed, requesting approval to proceed. Include the following information:
 - 1. Extent: Describe cutting and patching, show how they will be performed, and indicate why they cannot be avoided.
 - 2. Changes to In Place Construction: Describe anticipated results. Include changes to structural elements and operating components as well as changes in building's appearance and other significant visual elements.
 - 3. Products: List products to be used and firms or entities that will perform the Work.
 - 4. Dates: Indicate when cutting and patching will be performed.
 - 5. Utilities: List utilities that cutting and patching procedures will disturb or affect. List utilities that will be relocated and those that will be temporarily out of service. Indicate how long service will be disrupted.
 - 6. Structural Elements: Where cutting and patching involve adding reinforcement to

structural elements, submit details and engineering calculations showing integration of reinforcement with original structure.

7. Architect's Approval: Obtain approval of cutting and patching before cutting and patching. Approval does not waive right to later require removal and replacement of unsatisfactory work.

1.4 QUALITY ASSURANCE

- A. Structural Elements: Do not cut and patch structural elements in a manner that could change their load-carrying capacity or load-deflection ratio.
 1. Insert list of elements that might otherwise be overlooked as structural elements and that require Architect's approval of a cutting and patching proposal.
- B. Operational Elements: Do not cut and patch the following 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.
 1. Primary operational systems and equipment.
 2. Air or smoke barriers.
 3. Fire-protection systems.
 4. Control systems.
 5. Communication systems.
 6. Conveying systems.
 7. Electrical wiring systems.
 8. Operating systems of special construction in Division 13 Sections.
- C. Miscellaneous Elements: Do not cut and patch the following elements or related 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.
 1. Water, moisture, or vapor barriers.
 2. Membranes and flashings.
 3. Exterior curtain-wall construction.
 4. Equipment supports.
 5. Piping, ductwork, vessels, and equipment.
 6. Noise- and vibration-control elements and systems.
- D. Visual Requirements: Do not cut and patch construction in a manner that results in visual evidence of cutting and patching. Do not cut and patch construction exposed on the exterior or in occupied spaces 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.
- E. 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.

1.5 WARRANTY

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

PART 2 - PRODUCTS

2.1 MATERIALS

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

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine surfaces to be cut and patched and conditions under which cutting and patching are to be performed.
 - 1. Compatibility: Before patching, verify compatibility with and suitability of substrates, including compatibility with existing finishes or primers.
 - 2. Proceed with installation only after unsafe or unsatisfactory conditions have been corrected.

3.2 PERFORMANCE

- A. General: Employ skilled workers to perform cutting and patching. Proceed with cutting and patching at the earliest feasible time, and complete without delay.
 - 1. Cut in place construction to provide for installation of other components or performance of other construction, and subsequently patch as required to restore surfaces to their original condition.
- B. Cutting: Cut in place construction by sawing, drilling, breaking, chipping, grinding, and similar operations, 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 as small as possible, neatly to size required, and with minimum disturbance of adjacent surfaces. Temporarily cover openings when not in use.
 2. In Place 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. Proceed with patching after construction operations requiring cutting are complete.
- C. 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 possible. Provide materials and comply with installation requirements specified in other Sections of these Specifications.
1. Inspection: Where feasible, test and inspect patched areas after completion to demonstrate integrity of installation.
 2. Exposed Finishes: Restore exposed finishes of patched areas and extend finish restoration into retained adjoining construction in a manner that will eliminate evidence of patching and refinishing.
 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 existing 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, apply primer and intermediate paint coats 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 existing 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.

END OF SECTION

SECTION 033000 - CAST-IN-PLACE CONCRETE

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section includes cast-in-place concrete, including formwork, reinforcement, concrete materials, mixture design, placement procedures, and finishes, for the following:
 - 1. Site retaining walls.
 - 2. Grade beams.
 - 3. Slabs-on-grade.
 - 4. Suspended slabs and Beams.
 - 5. Columns.
 - 6. Concrete toppings.
 - 7. Fill for steel pan stairs.
 - 8. Equipment pads and bases.
 - 9. Outdoor concrete stairs.
- B. Related Sections:
 - 1. Division 31 Section "Earthwork" for drainage fill under slabs-on-grade.
 - 2. Section 01 7419 CONSTRUCTION WASTE MANAGEMENT AND DISPOSAL.
 - 3. See Section 033300 Architectural Concrete.

1.3 DEFINITIONS

- A. Cementitious Materials: Portland cement alone or in combination with one or more of the following: Fly ash and other pozzolans; subject to compliance with requirements.
- B. Exposed Cast-in-Place Concrete: Formed concrete that is exposed to view on surfaces of completed structure or building and that requires special concrete materials, formwork, placement, or finishes to obtain specified architectural appearance.
- C. Visual Mockups: Mockups provided by the Contractor and designated by the Architect that reflect acceptable visual appearance of exposed cast-in-place concrete in full scale, three dimensional mock-ups.

1.4 SUBMITTALS

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

- B. Design Mixtures: For each concrete mixture. Submit alternate design mixtures when characteristics of materials, Project conditions, weather, test results, or other circumstances warrant adjustments.
 - 1. Indicate amounts of mixing water to be withheld for later addition at Project site.
- C. Steel Reinforcement Shop Drawings: Placing drawings that detail fabrication, bending, and placement. Include bar sizes, lengths, material, grade, bar schedules, stirrup spacing, bent bar diagrams, bar arrangement, splices and laps, mechanical connections, tie spacing, hoop spacing, and supports for concrete reinforcement.
- D. Cold-weather/Hot-weather Concrete Placement Procedure Plan: Indicate steps and procedures to be undertaken during concrete placements during cold and hot weather conditions.
- E. Construction Joint Layout: Indicate proposed construction joints required to construct the structure.
 - 1. Location of construction joints is subject to approval of the Architect.
- F. Qualification Data: For Installer.
- G. Material Certificates: For each of the following, signed by manufacturers:
 - 1. Cementitious materials.
 - 2. Admixtures.
 - 3. Form materials and form-release agents.
 - 4. Steel reinforcement and accessories.
 - 5. Waterstops.
 - 6. Floor and slab treatments.
 - 7. Curing compounds.
 - 8. Bonding agents.
 - 9. Adhesives.
 - 10. Vapor retarders.
 - 11. Semirigid joint filler.
 - 12. Joint-filler strips.
 - 13. Repair materials.
- H. Material Test Reports: For the following, from a qualified testing agency, indicating compliance with requirements:
 - 1. Aggregates.
- I. Floor surface flatness and levelness measurements indicating compliance with specified tolerances.
- J. Field quality-control reports.
- K. Minutes of preinstallation conference.

1.5 QUALITY ASSURANCE

- A. Installer Qualifications: Installer with a successful record of a minimum of five (5) years of projects completed in similar size, construction type and scope as this project.

1. An installer who employs personnel qualified as ACI-certified Flatwork Technician and Finisher and an on site 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 requirements for production facilities and equipment.
 1. Manufacturer certified according to NRMCA's "Certification of Ready Mixed Concrete Production Facilities."
- C. Mix Design Testing Agency Qualifications: An independent agency, qualified according to ASTM C 1077 and ASTM E 329 for testing indicated.
 1. 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. Source Limitations for Exposed Cast-in-Place Concrete:
 1. Obtain each color, size, type, and variety of concrete material and concrete mixture from a single manufacturer with resources to provide cast-in-place concrete of consistent quality in appearance and physical properties.
 2. Materials: Obtain each concrete formwork, mix, aggregate, and finishing material component from one source or manufacturer.
- F. Welding Qualifications: Qualify procedures and personnel according to AWS D1.4/D 1.4M, "Structural Welding Code - Reinforcing Steel."
- G. ACI Publications: Comply with the following unless modified by requirements in the Contract Documents:
 1. ACI 301, "Specifications for Structural Concrete"
 2. ACI 117, "Specifications for Tolerances for Concrete Construction and Materials."
 3. ACI 318, "Building Code Requirements for Structural Concrete."
- H. Concrete Testing Service: Engage a qualified independent testing agency to perform material evaluation tests and to design concrete mixtures.
- I. Preinstallation Conference: Conduct conference.
 1. Before submitting design mixtures, review concrete design mixture and examine procedures for ensuring quality of concrete materials. Require representatives of each entity directly concerned with cast-in-place concrete to attend, including the following:
 - a. Contractor's superintendent.
 - b. Independent testing agency responsible for concrete design mixtures.
 - c. Ready-mix concrete manufacturer.
 - d. Concrete subcontractor.
 - e. Special concrete finish subcontractor.

- f. Project Special Inspector.
 - 2. Review special inspection and testing and inspecting agency procedures for field quality control, concrete finishes and finishing, cold- and hot-weather concreting procedures, curing procedures, construction contraction and isolation joints, and joint-filler strips, semirigid joint fillers, forms and form removal limitations, vapor-retarder installation, anchor rod and anchorage device installation tolerances, steel reinforcement installation, embedded items, floor and slab flatness and levelness measurement, concrete repair procedures, and concrete protection.
- 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. Steel-Ply HDO Plywood, metal, or other approved panel materials.
- B. Rough-Formed Finished Concrete: Plywood, lumber, metal, or another approved material. Provide lumber dressed on at least two edges and one side for tight fit.
- C. Forms for Cylindrical Columns, Pedestals, and Supports: Metal, glass-fiber-reinforced plastic, paper, or fiber tubes that will produce surfaces with gradual or abrupt irregularities not exceeding specified formwork surface class. Provide units with sufficient wall thickness to resist plastic concrete loads without detrimental deformation.
- D. Chamfer Strips: Wood, metal, PVC, or rubber strips, 3/4 by 3/4 inch, minimum.
- E. Form-Release Agent: Commercially formulated form-release agent that will not bond with, stain, or adversely affect concrete surfaces and will not impair subsequent treatments of concrete surfaces.
 - 1. Formulate form-release agent with rust inhibitor for steel form-facing materials.
- F. Form Ties: Factory-fabricated, removable or snap-off metal or glass-fiber-reinforced plastic form ties designed to resist lateral pressure of fresh concrete on forms and to prevent spalling of concrete on removal.
 - 1. Furnish units that will leave no corrodible metal closer than 1 inch to the plane of exposed concrete surface.
 - 2. Furnish ties that, when removed, will leave holes no larger than 1 inch in diameter in concrete surface.

2.2 STEEL REINFORCEMENT

- A. Reinforcing Bars: ASTM A 615, Grade 60, deformed.
- B. Reinforcing Bars: ASTM A 615, Grade 75, deformed.
- C. Low-Alloy-Steel Reinforcing Bars: ASTM A 706, deformed.
- D. Plain-Steel Wire: ASTM A 82 as drawn.
- E. Plain-Steel Welded Wire Reinforcement: ASTM A A1064/A1064M, plain, fabricated from as-drawn steel wire into flat sheets.

2.3 REINFORCEMENT ACCESSORIES

- A. Recycled Content of Steel Products and Regional Material: Postconsumer recycled content plus one-half of preconsumer recycled content not less than 25 percent. 100% by weight of steel product extracted, harvested or recovered, as well as manufactured, within 500 miles of the project site.
- B. Smooth Dowel Bars: ASTM A 615, Grade 60, plain-steel bars, cut true to length with ends square and free of burrs.
- C. 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.

2.4 CONCRETE MATERIALS

- A. Cementitious Material: Use the following cementitious materials, of the same type, brand, and source, throughout Project:
 - 1. Portland Cement: ASTM C 150, Type I/II. Supplement with the following:
 - a. Fly Ash: ASTM C 618, Class F.
- B. Normal-Weight Aggregates: ASTM C 33, coarse aggregate or better, graded. Provide aggregates from a single source with documented service record data of at least 5 years' satisfactory service in similar applications and service conditions using similar aggregates and cementitious materials.
 - 1. Maximum Coarse-Aggregate Size: 3/4 inch nominal.
 - 2. Fine Aggregate: Free of materials with deleterious reactivity to alkali in cement.
- C. Water: ASTM C 94, potable.

2.5 ADMIXTURES

- A. Air-Entraining Admixture: ASTM C 260. Comply with Western Carolina University SD Section A10.2.6. See part 3.17.3 for testing.
- B. Chemical Admixtures: Use of admixtures is at the contractor's discretion. When used provide admixtures certified by manufacturer to be compatible with other admixtures and that will not contribute water-soluble chloride ions exceeding those permitted in hardened concrete. Do not use calcium chloride or admixtures containing calcium chloride.
 - 1. Water-Reducing Admixture: ASTM C 494, Type A.
 - 2. Retarding Admixture: ASTM C 494, Type B.
 - 3. Water-Reducing and Retarding Admixture: ASTM C 494, Type D.
 - 4. High-Range, Water-Reducing Admixture: ASTM C 494, Type F.
 - 5. High-Range, Water-Reducing and Retarding Admixture: ASTM C 494, Type G.
 - 6. Plasticizing and Retarding Admixture: ASTM C 1017, Type II.

2.6 WATERSTOPS

- A. See specification Section 03 1513 Waterstops.

2.7 VAPOR RETARDERS

- A. See specification Section 07 2616 Underslab Vapor Retarders.

2.8 CURING MATERIALS

- A. Evaporation Retarder: Waterborne, monomolecular film forming, manufactured for application to fresh concrete.
 - 1. Products: Subject to compliance with requirements, provide one of the following:
 - a. Axim Italcementi Group, Inc.; CATEXOL CimFilm.
 - b. BASF Construction Chemicals - Building Systems; Confilm.
 - c. ChemMasters; SprayFilm.
 - d. Conspec by Dayton Superior; Aquafilm.
 - e. Dayton Superior Corporation; Sure Film (J-74).
 - f. Edoco by Dayton Superior; BurkeFilm.
 - g. Euclid Chemical Company (The), an RPM company; Eucobar.
 - h. Kaufman Products, Inc.; Vapor-Aid.
 - i. Lambert Corporation; LAMBCO Skin.
 - j. L&M Construction Chemicals, Inc.; E-CON.
 - k. Meadows, W. R., Inc.; EVAPRE.
 - l. Metalcrete Industries; Waterhold.
 - m. Nox-Crete Products Group; MONOFILM.
 - n. Sika Corporation; SikaFilm.
 - o. SpecChem, LLC; Spec Film.
 - p. Symons by Dayton Superior; Finishing Aid.
 - q. TK Products, Division of Sierra Corporation; TK-2120 TRI-FILM.

- r. Unitex; PRO-FILM.
 - s. Vexcon Chemicals, Inc.; Certi-Vex Envio Set.
- B. Moisture-Retaining Cover: ASTM C 171, polyethylene film or white burlap-polyethylene sheet.
- 1. For burnished or polished slabs polyethylene film is not permitted.
- C. Clear, Waterborne, Membrane-Forming Curing Compound: ASTM C 309, Type 1, Class B, nondissipating, certified by curing compound manufacturer to not interfere with bonding of floor covering.
- 1. Products: Subject to compliance with requirements, provide one of the following:
 - a. Anti-Hydro International, Inc.; AH Clear Cure WB.
 - b. BASF Construction Chemicals - Building Systems; Kure-N-Seal WB.
 - c. ChemMasters; Safe-Cure & Seal 20.
 - d. Conspec by Dayton Superior; Cure and Seal WB.
 - e. Cresset Chemical Company; Crete-Trete 309-VOC Cure & Seal.
 - f. Dayton Superior Corporation; Safe Cure and Seal (J-18).
 - g. Edoco by Dayton Superior; Spartan Cote WB II.
 - h. Euclid Chemical Company (The), an RPM company; Aqua Cure VOX; Clearseal WB 150.
 - i. Kaufman Products, Inc.; Cure & Seal 309 Emulsion.
 - j. Lambert Corporation; Glazecote Sealer-20.
 - k. L&M Construction Chemicals, Inc.; Dress & Seal WB.
 - l. Meadows, W. R., Inc.; Vocomp-20.
 - m. Metalcrete Industries; Metcure.
 - n. Nox-Crete Products Group; Cure & Seal 150E.
 - o. Symons by Dayton Superior; Cure & Seal 18 Percent E.
 - p. TK Products, Division of Sierra Corporation; TK-2519 WB.
 - q. Vexcon Chemicals, Inc.; Starseal 309.
- D. Clear, Waterborne, Membrane-Forming Curing and Sealing Compound: ASTM C 1315, Type 1, Class A certified by curing and sealing compound manufacturer to not interfere with bonding of floor covering.
- 1. Products: Subject to compliance with requirements, provide one of the following:
 - a. BASF Construction Chemicals - Building Systems; Kure 1315.
 - b. ChemMasters; Polyseal WB.
 - c. Conspec by Dayton Superior; Sealcure 1315 WB.
 - d. Edoco by Dayton Superior; Cureseal 1315 WB.
 - e. Euclid Chemical Company (The), an RPM company; Super Diamond Clear VOX; LusterSeal WB 300.
 - f. Kaufman Products, Inc.; Sure Cure 25 Emulsion.
 - g. Lambert Corporation; UV Safe Seal.
 - h. L&M Construction Chemicals, Inc.; Lumiseal WB Plus.
 - i. Meadows, W. R., Inc.; Vocomp-30.
 - j. Metalcrete Industries; Metcure 30.
 - k. Right Pointe; Right Sheen WB30.
 - l. Symons by Dayton Superior; Cure & Seal 31 Percent E.
 - m. Vexcon Chemicals, Inc.; Vexcon Starseal 1315.

2.9 RELATED MATERIALS

- A. Expansion- and Isolation-Joint-Filler Strips: ASTM D 1751, asphalt-saturated cellulosic fiber. Filler strips shall be ½" deep removable 'tear off strips' to provide preformed pocket for sealant installation.
- 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, Type II, non-redispersible, acrylic emulsion or styrene butadiene.
- D. Reglets: Fabricate reglets of not less than 0.022-inch- thick, galvanized-steel sheet. Temporarily fill or cover face opening of reglet to prevent intrusion of concrete or debris.
- E. Dovetail Anchor Slots: See specification Section 042 000.

2.10 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.
 - 5. Coordinate compatibility with Division 9.
- 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.
 - 5. Coordinate compatibility with Division 9.

2.11 CONCRETE MIXTURES, GENERAL

- A. Prepare design mixtures for each type and strength of concrete, proportioned on the basis of laboratory trial mixture or field test data, or both, according to ACI 301.
 - 1. Use a qualified independent testing agency for preparing and reporting proposed mixture designs based on laboratory trial mixtures.
- B. Cementitious Materials: Limit percentage, by weight, of cementitious materials other than portland cement in concrete as follows:

1. Fly Ash: 25 percent.
 2. For polished slabs limit fly ash to 20 percent.
- C. Limit water-soluble, chloride-ion content in hardened concrete to 1.00 percent by weight of cement.
- D. Admixtures: Use admixtures according to manufacturer's written instructions.
1. Use water-reducing, high-range water-reducing, or plasticizing admixture in concrete, as required, for placement and workability.
 2. Use water-reducing and retarding admixture when required by high temperatures, low humidity, or other adverse placement conditions.
 3. Use water-reducing admixture in pumped concrete and concrete with a water-cementitious materials ratio below 0.50.

2.12 CONCRETE MIXTURES FOR BUILDING ELEMENTS

- A. Footings: Proportion normal-weight concrete mixture as follows:
1. Minimum Compressive Strength: 4000 psi at 28 days.
 2. Maximum Water-Cementitious Materials Ratio: 0.50.
 3. Slump Limit: 4 inches plus or minus 1 inch at point of delivery (prior to pumping).
 4. Slump Limit for concrete containing high-range water-reducing admixture or plasticizing admixture: 8 inches maximum for concrete with approved design mix slump of 3 to 5 inches before adding high-range water-reducing admixture or plasticizing admixture.
 5. Air Content: 2 percent, plus or minus 1.5 percent at point of delivery (prior to pumping).
- B. Grade Beams: Proportion normal-weight concrete mixture as follows:
1. Minimum Compressive Strength: 4000 psi at 28 days.
 2. Maximum Water-Cementitious Materials Ratio: 0.50.
 3. Slump Limit: 4 inches plus or minus 1 inch at point of delivery (prior to pumping).
 4. Slump Limit for concrete containing high-range water-reducing admixture or plasticizing admixture: 8 inches maximum for concrete with approved design mix slump of 3 to 5 inches before adding high-range water-reducing admixture or plasticizing admixture.
 5. Air Content: 2 percent, plus or minus 1.5 percent at point of delivery (prior to pumping).
- C. Below Grade Walls, Wall, Columns, Pedestals, and Suspended slab and Beams: Proportion normal-weight (3/8" max. aggregate size) concrete mixture as follows:
1. Minimum Compressive Strength: 5000 psi at 28 days.
 2. Maximum Water-Cementitious Materials Ratio: 0.45.
 - ~~3.~~ Slump Limit: 4 inches plus or minus 1 inch at point of delivery (prior to pumping).
 4. Air Content: 4 percent, plus or minus 1.5 percent at point of delivery (prior to pumping).
 5. Provide the same admixtures for all concrete placed in shear walls to ensure uniform appearance of exposed concrete surfaces.
- D. Slabs-on-Grade (Interior): Proportion normal-weight concrete mixture as follows:
1. Minimum Compressive Strength: 4000 psi at 28 days.
 2. Maximum Water-Cementitious Materials Ratio: 0.50.

3. Slump Limit: 4 inches plus or minus 1 inch at point of delivery (prior to pumping).
 4. Slump Limit for concrete containing high-range water-reducing admixture or plasticizing admixture: 8 inches maximum for concrete with approved design mix slump of 3 to 5 inches before adding high-range water-reducing admixture or plasticizing admixture.
 5. Air Content: 2 percent, plus or minus 1.5 percent at point of delivery (prior to pumping).
 6. Air Content: Do not allow air content of trowel-finished floors to exceed 3 percent at point of delivery (prior to pumping).
- E. Slabs-on-Grade (Exterior): Proportion normal-weight concrete mixture as follows:
1. Minimum Compressive Strength: 4500 psi at 28 days.
 2. Maximum Water-Cementitious Materials Ratio: 0.45.
 3. Slump Limit: 4 inches plus or minus 1 inch at point of delivery (prior to pumping).
 4. Slump Limit for concrete containing high-range water-reducing admixture or plasticizing admixture: 8 inches maximum for concrete with approved design mix slump of 3 to 5 inches before adding high-range water-reducing admixture or plasticizing admixture.
 5. Air Content: 5 percent, plus or minus 1.5 percent at point of delivery (prior to pumping).
 6. Air Content: Do not allow air content of trowel-finished floors to exceed 3 percent at point of delivery (prior to pumping).
 7. (prior to pumping).
 8. Provide crystalline waterproofing additive per Section 03 3010.
- F. Concrete Toppings, Equipment Pads and Bases: Proportion normal-weight concrete mixture as follows:
1. Minimum Compressive Strength: 3500 psi at 28 days.
 2. Slump Limit: 4 inches plus or minus 1 inch at point of delivery (prior to pumping).
 3. Slump Limit for concrete containing high-range water-reducing admixture or plasticizing admixture: 8 inches maximum for concrete with approved design mix slump of 3 to 5 inches before adding high-range water-reducing admixture or plasticizing admixture.
 4. Air Content: Do not exceed 3 percent.
- G. Fill for Steel Pan Stairs: Proportion normal-weight concrete mixture as follows:
1. Minimum Compressive Strength: 3000 psi at 28 days.
 2. Maximum Water-Cementitious Materials Ratio: 0.65.
 3. Slump Limit: 4 inches plus or minus 1 inch at point of delivery (prior to pumping).
 4. Slump Limit for concrete containing high-range water-reducing admixture or plasticizing admixture: 8 inches maximum for concrete with approved design mix slump of 3 to 5 inches before adding high-range water-reducing admixture or plasticizing admixture.
 5. Air Content: 2 percent, plus or minus 1.5 percent at point of delivery (prior to pumping).
- H. Elevator pits and sumps: Proportion normal-weight (3/8" max. aggregate size) concrete mixture as follows:
1. Minimum Compressive Strength: 5000 psi at 28 days.
 2. Maximum Water-Cementitious Materials Ratio: 0.45.
 - ~~3.~~ Slump Limit: 4 inches plus or minus 1 inch at point of delivery (prior to pumping).
 4. Air Content: 4 percent, plus or minus 1.5 percent at point of delivery (prior to pumping).
 5. Provide the same admixtures for all concrete placed in shear walls to ensure uniform appearance of exposed concrete surfaces. Provide crystalline waterproofing additive per Section 03 3010.

2.13 FABRICATING REINFORCEMENT

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

2.14 CONCRETE MIXING

- A. Ready-Mixed Concrete: Measure, batch, mix, and deliver concrete according to ASTM C 94, 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. (Architectural exposed to view cast in place concrete walls, columns, beams, slabs, and site walls)
 - 2. Class B, 1/4 inch for rough-formed finished surfaces. (Below grade cast in place concrete)
- 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. Provide 3/4 inch chamfer at all 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.
 - 1. At exposed concrete surfaces, verify that form-release agents do not stain or mark the concrete by sample panel and mockup.
 - 2. At exposed concrete surfaces, do not allow excess form-coating materials to accumulate in forms or come in contact with concrete surfaces against which fresh concrete will be placed.
- M. At exposed concrete surfaces of shear walls, curbs, and other exposed walls, layout form joints, reveals, and ties as shown on the Drawings and plumb and true to line. Locate vertical construction joints behind rustications and away from corners. If not shown on Drawings, submit a Request for Information to the Architect before proceeding with layout.
- N. At exposed concrete surfaces of shear walls, nail or screw heads shall not occur at contact surface with concrete. Form surfaces in contact with concrete shall be screw attached from backside, glued, or fastened using other approved method.
- O. Form exposed concrete surfaces of shear walls first. Indicate butted form joints on shop drawings and locate in field only as shown on the approved shop drawings. Perform work necessary to align and seal joints of abutting panels prior to placement of reinforcement.
 - 1. Limit concrete surface irregularities, designated by ACI 347R as abrupt or gradual, to Class A, 1/8 inch.
- P. At exposed concrete surfaces of shear walls, the Architect shall approve facing of formwork prior to concrete placement.

3.2 EMBEDDED ITEMS

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

3.3 REMOVING AND REUSING FORMS

- A. General: Formwork for sides of beams, walls, columns, and similar parts of the Work that does not support weight of concrete may be removed after cumulatively curing at not less than 50 deg F for 24 hours after placing concrete. 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 75 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

- A. Comply with ACI 318 and ACI 301 for design, installation, and removal of shoring.

3.5 VAPOR RETARDERS

- A. Sheet Vapor Retarder: ASTM E 1745, Class A. Include manufacturer's recommended adhesive or pressure-sensitive tape.
 - 1. Products: Subject to compliance with requirements, provide one of the following the following:
 - a. Carlisle Coatings & Waterproofing, Inc.; Blackline 400.
 - b. Fortifiber Building Systems Group; Moistop Ultra 10.
 - c. Grace Construction Products, W. R. Grace & Co.; Florprufe 120.
 - d. Insulation Solutions, Inc.; Viper VaporCheck 10.
 - e. Meadows, W. R., Inc.; Perminator 10 mil.
 - f. Raven Industries Inc.; Vapor Block 10.
 - g. Reef Industries, Inc.; Griffolyn 10 mil Green.
 - h. Stego Industries, LLC; Stego Wrap 10 mil Class A.
- B. Granular Fill: Clean mixture of crushed stone or crushed or uncrushed gravel; ASTM D 448, Size 57, with 100 percent passing a 1-1/2-inch sieve and 0 to 5 percent passing a No. 8 sieve.

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.
 1. Weld reinforcing bars according to AWS D1.4, where indicated.
- D. Set wire ties with ends directed into concrete, not toward exposed concrete surfaces.
- E. Install welded wire reinforcement in longest practicable lengths on bar supports spaced at a maximum of 48 inches on center in each direction to minimize sagging. Lap edges and ends of adjoining sheets 8" minimum. 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 slabs on metal deck as indicated on drawings.
 4. 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.
 5. Locate horizontal joints in walls and columns at underside of floors, slabs, beams, and girders and at the top of footings or floor slabs.
 6. Locate joints beside piers integral with walls, near corners, and in concealed locations where possible.
- C. Control Joints in Slabs-on-Grade: Form weakened-plane control joints, sectioning concrete into areas as indicated. Construct control joints for a depth equal to at least one-third of concrete thickness as follows:
 1. Sawed Joints: Form contraction joints with power saws equipped with shatterproof abrasive or diamond-rimmed blades. Cut 1/8-inch-wide joints into concrete when cutting action will not tear, abrade, or otherwise damage surface and before slab is eight hours old.
 2. Control joints shall be spaced no wider than 30 times the slab thickness. All panels shall be as close as possible to square and shall not exceed 1.5 times the width.
- 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. Filler strips shall be ½" deep removable 'tear off strips' to provide preformed pocket for sealant installation.
 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 smooth dowel bars and support assemblies at joints where indicated. Lubricate or asphalt coat one-half of smooth dowel length to prevent concrete bonding to one side of joint.

3.8 WATERSTOPS

- A. Flexible Waterstops: Install in construction joints and at other joints indicated to form a continuous diaphragm. Install in longest lengths practicable. Support and protect exposed waterstops during progress of the Work. Field fabricate joints in waterstops according to manufacturer's written instructions.
- B. Self-Expanding Strip Waterstops: Install in construction joints and at other locations indicated, according to manufacturer's written instructions, adhesive bonding, mechanically fastening, and firmly pressing into place. Install in longest lengths practicable

3.9 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 unless water is held back at plant and amount of held back water is printed on the batch ticket, subject to limitations of ACI 301.
1. Do not add water to concrete after adding high-range water-reducing admixtures to mixture.
- C. 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.
- D. 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.
- E. 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. Contractor will submit cold-weather concrete placement plan that will be used to undertake cold-weather concrete placement techniques when required.
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.
- F. Hot-Weather Placement: Comply with ACI 305 and as follows. Contractor will submit hot-weather concrete placement plan that will be used to undertake hot-weather concrete placement techniques when required.
1. Maintain concrete temperature below 90 deg F at time of placement.
- G. Contractor to be aware of weather conditions during placement of exposed cast-in-place concrete. Contractor to take appropriate measures, including rescheduling the concrete pour if required, to avoid using hot-weather and cold-weather placement techniques which may affect the finish appearance of the exposed concrete.
- H. Aluminum conduits and pipes shall not be embedded in any concrete.

3.10 FINISHING FORMED SURFACES

- A. Rough-Formed Finish: As-cast concrete texture imparted by form-facing material with tie holes and defects repaired and patched. Remove fins and other projections that exceed specified limits on formed-surface irregularities.
1. Apply to concrete surfaces not exposed to public view.
- B. Smooth-Formed Finish: As-cast concrete texture imparted by form-facing material, arranged in an orderly and symmetrical manner with a minimum of seams. Repair and patch tie holes and defects. Remove fins and other projections that exceed specified limits on formed-surface irregularities.
1. Apply to concrete surfaces exposed to public view.
- C. Rubbed Finish: Apply the following to smooth-formed finished as-cast concrete where indicated:

1. Smooth-Rubbed Finish: Not later than one day after form removal, moisten concrete surfaces and rub with carborundum brick or another abrasive until producing a uniform color and texture. Do not apply cement grout other than that created by the rubbing process.
 2. Grout-Cleaned Finish: Wet concrete surfaces and apply grout of a consistency of thick paint to coat surfaces and fill small holes. Mix one part portland cement to one and one-half parts fine sand with a 1:1 mixture of bonding admixture and water. Add white portland cement in amounts determined by trial patches so color of dry grout will match adjacent surfaces. Scrub grout into voids and remove excess grout. When grout whitens, rub surface with clean burlap and keep surface damp by fog spray for at least 36 hours.
- D. Related Unformed Surfaces: At tops of walls, horizontal offsets, and similar unformed surfaces adjacent to formed surfaces, strike off smooth and finish with a texture matching adjacent formed surfaces. Continue final surface treatment of formed surfaces uniformly across adjacent unformed surfaces unless otherwise indicated.

3.11 FINISHING FLOORS AND SLABS

- A. General: Comply with ACI 302.1R recommendations for screeding, restraighening, and finishing operations for concrete surfaces. Do not wet concrete surfaces.
- B. Scratch Finish: While still plastic, texture concrete surface that has been screeded and bull-floated or darbied. Use stiff brushes, brooms, or rakes to produce a profile amplitude of 1/4 inch in one direction.
1. Apply scratch finish to surfaces indicated, to receive concrete floor toppings, and to receive mortar setting beds for bonded cementitious floor finishes.
- C. Float Finish: Consolidate surface with power-driven floats or by hand floating if area is small or inaccessible to power driven floats. Restraighten, cut down high spots, and fill low spots. Repeat float passes and restraighening until surface is left with a uniform, smooth, granular texture.
1. Apply float finish to surfaces indicated, to receive trowel finish, to be covered with fluid-applied or sheet waterproofing, built-up or membrane roofing, or sand-bed terrazzo.
- D. Trowel Finish: After applying float finish, apply first troweling and consolidate concrete by hand or power-driven trowel. Continue troweling passes and restraighten until surface is free of trowel marks and uniform in texture and appearance. Grind smooth any surface defects that would telegraph through applied coatings or floor coverings.
1. Apply a trowel finish to surfaces indicated, exposed to view, to be covered with resilient flooring, carpet, ceramic or quarry tile set over a cleavage membrane, paint, or another thin-film-finish coating system.
 2. Finish surfaces to receive hardened or burnished or polished treatment (See Specification 03 3550) with not less than three (3) trowel passes per ACI 302.1R, Class 5 without burn marks.
 3. Finish surfaces to the following tolerances, according to ASTM E 1155, for a randomly trafficked floor surface:
 - a. For Slabs on Grade: Specified overall values of flatness, F(F) 35; and of levelness, F(L) 30; with minimum local values of flatness, F(F) 26; and of levelness, F(L) 20.
 - b. For Slabs on metal deck: Specified overall values of flatness, F(F) 30; with minimum local values of flatness, F(F) 26.

- c. Overall values of flatness and levelness are to be determined for each individual area of concrete placed at one time.
 - d. Minimum floor area for local flatness shall be no less than 20 feet x 30 feet.
- E. Trowel and Fine-Broom Finish: Apply a first trowel finish to surfaces indicated and where ceramic or quarry tile is to be installed by either thickset or thin-set method. While concrete is still plastic, slightly scarify surface with a fine broom.
 - 1. Comply with flatness and levelness tolerances for trowel-finished floor surfaces.
- F. Broom Finish: Apply a broom finish to exterior concrete platforms, exterior, elevated concrete slab areas, steps, ramps, and elsewhere as indicated.
 - 1. Immediately after float finishing, slightly roughen trafficked surface by brooming with fiber-bristle broom perpendicular to main traffic route. Coordinate required final finish with Architect before application.

3.12 MISCELLANEOUS CONCRETE ITEMS

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

3.13 CONCRETE PROTECTING AND CURING

- A. General: Protect freshly placed concrete from premature drying and excessive cold or hot temperatures. Comply with ACI 306.1 for cold-weather protection and ACI 305 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 basement walls, underside of beams, supported slabs, and other similar surfaces. If forms remain during curing period additional curing is at contractor's option. 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.

- E. Cure concrete according to ACI 308.1, by one or a combination of the following methods:
1. Moisture-Retaining-Cover Curing: Cover concrete surfaces with moisture-retaining cover for curing concrete, placed in widest practicable width, with sides and ends lapped at least 12 inches, and sealed by waterproof tape or adhesive. Cure for seven days. Immediately repair any holes or tears during curing period using cover material and waterproof tape.
 - a. Use moisture-retaining covers to cure concrete slab surfaces. Moisture-retaining covers by be used to cure all other concrete at contractor's option.
 - b. For slabs to receive hardened and burnished or polished treatment (See Specification Section 03 3550), do not use polyethylene Sheet. Burlap-polyethylene sheet is acceptable.
 2. Curing Compound: Apply uniformly in continuous operation by power spray or roller according to manufacturer's written instructions. Recoat areas subjected to heavy rainfall within three hours after initial application. Maintain continuity of coating and repair damage during curing period.
 - a. Cure concrete other than concrete slab surfaces with a curing compound at the contractor's option.
 3. Curing and Sealing Compound: Apply uniformly to floors and slabs only where indicated in a continuous operation by power spray or roller according to manufacturer's written instructions. Recoat areas subjected to heavy rainfall within three hours after initial application. Repeat process 24 hours later and apply a second coat. Maintain continuity of coating and repair damage during curing period.

3.14 JOINT FILLING

- A. Prepare, clean, and install joint filler according to manufacturer's written instructions.
1. Defer joint filling until concrete has aged at least one month. Do not fill joints until construction traffic has permanently ceased.
- B. Remove dirt, debris, saw cuttings, curing compounds, and sealers from joints; leave contact faces of joint clean and dry.
- C. Install semirigid joint filler full depth in saw-cut joints and at least 2 inches deep in formed joints. Overfill joint and trim joint filler flush with top of joint after hardening.

3.15 CONCRETE SURFACE REPAIRS

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

3.16 EXPOSED CONCRETE REPAIRS, PROTECTION, AND CLEANING

- A. Repair and cure damaged finished surfaces of exposed cast-in-place concrete when approved by Architect. Match repairs to color, texture, and uniformity of surrounding surfaces and to repairs on approved mockups.
 - 1. Remove and replace exposed cast-in-place concrete that cannot be repaired and cured to Architect's approval.
- B. Protect corners, edges, and surfaces of exposed cast-in-place concrete from damage; use guards and barricades.
- C. Protect exposed concrete from staining, laitance, and contamination during remainder of construction period.
- D. Clean exposed cast-in-place concrete surfaces after finish treatment to remove stains, markings, dust, and debris.
- E. Wash and rinse surfaces according to concrete finish applicator's written instructions. Protect other Work from staining or damage due to cleaning operations.
 - 1. Do not use cleaning materials or processes that could change the appearance of exposed cast-in-place concrete finishes.

3.17 FIELD QUALITY CONTROL

- A. Testing and Inspecting: Owner will engage a qualified testing and inspecting agency to perform field tests and inspections and prepare test reports.
- B. 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 composite sample(s) for each day's pour of each concrete mixture exceeding 5 cu. yd per the following:

Concrete Delivered	Composite Samples Obtained
Less than 5 cubic yards	None
5 cubic yards to 49 cubic yards	1 (take from first load delivered)
50 cubic yards to 100 cubic yards	1
Over 100 cubic yards	1 for each 100 cubic yards or fraction thereof

- 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.

2. Slump: ASTM C 143; one test at point of placement (back of concrete truck) prior to conveyance by pump, bucket, etc. for each composite sample, but not less than one test for each day's pour of each concrete mixture. Perform additional tests when concrete consistency appears to change.
 3. Air Content: ASTM C 231, pressure method, for normal-weight concrete; ASTM C 173 volumetric method, for structural lightweight concrete; one test at point of placement (back of concrete truck) prior to conveyance by pump, bucket, etc. for each composite sample, but not less than one test for each day's pour of each concrete mixture.
 4. Concrete Temperature: ASTM C 1064; one test hourly when air temperature is 40 deg F and below and when 80 deg F and above, and one test for each composite sample.
 5. Unit Weight: ASTM C 567, fresh unit weight of structural lightweight concrete; one test at point of placement (back of concrete truck) prior to conveyance by pump, bucket, etc. for each composite sample, but not less than one test for each day's pour of each concrete mixture.
 6. Compression Test Specimens: ASTM C 31.
 - a. Cast and laboratory cure five, 6 inch by 12 inch (or seven 4 inch by 8 inch) standard cylinder specimens for each composite sample.
 7. Compressive-Strength Tests: ASTM C 39; test one 6 by 12 inch (or one 4 by 8) laboratory-cured specimen at 7 days and two 6 by 12 (or three 4 by 8 inch) laboratory-cured specimens at 28 days and hold two 6 by 12 (or three 4 by 8 inch) laboratory-cured specimens in reserve for 56 day test if required.
 - a. 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. 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.
 9. 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.
 10. 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.
 11. Additional Tests: Testing and inspecting agency shall make additional tests of concrete when test results indicate that slump, air entrainment, compressive strengths, or other requirements have not been met, as directed by Architect. Testing and inspecting agency may conduct tests to determine adequacy of concrete by cored cylinders complying with ASTM C 42 or by other methods as directed by Architect.
 12. Additional testing and inspecting, at Contractor's expense, will be performed to determine compliance of replaced or additional work with specified requirements.
 13. Correct deficiencies in the Work that test reports and inspections indicate do not comply with the Contract Documents.
- C. Measure floor and slab flatness and levelness according to ASTM E 1155 within 24 hours of finishing.

END OF SECTION 033000

SECTION 042000 - UNIT MASONRY

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Face brick.
2. Ground face CMU.
3. Cast stone.
4. Mortar and grout.
5. Masonry joint reinforcement.
6. Ties and anchors.
7. Embedded flashing.
8. Miscellaneous masonry accessories.
9. Cavity-wall insulation.
10. Protection, pointing, and cleaning of masonry.

B. Related Documents and Sections: Examine Contract Documents for requirements that directly affect or are affected by Work of this Section. Other Documents and Sections that directly relate to work of this Section include, but are not limited to:

1. General provisions of the Contract, including General and Supplementary Requirements in Division 00, and Division 01 Specification Sections.
2. Section 051200 - STRUCTURAL STEEL FRAMING.
3. Section 055000 - METAL FABRICATIONS.
4. Section 078413 - PENETRATION FIRESTOPPING
5. Section 079200 - JOINT SEALANTS
6. Section 072100 - BUILDING INSULATION.
7. Section 076200 - SHEET METAL FLASHING AND TRIM.

1.2 ACTION SUBMITTALS

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

B. Submit Shop Drawings for the following:

1. Anchoring Details
2. Control and expansion joint locations and details
3. Special brick shapes
4. Flashing at typical lintels indicating relationship of flashing to lintel hangers.
5. Reinforcing bar shop fabrication and field placement drawings for each wall in elevation.

6. Fabricated Flashing: Detail corner units, end-dam units, and other special applications.

C. Samples: Submit Samples for the following:

1. Each type of face brick in sufficient number and color (not less than 5) to show full range of color, texture and shade. Submit certification that brick meets ASTM standards specified herein.
 - a. Submit samples of all special shapes required showing color range and sizes.
2. Joint reinforcing, each type, width and proposed location (labeled).
3. Anchors, wedges and ties, each type, width and proposed location (labeled).
4. Joint filler, each type.
5. Flashing, including splice sample, 12" long.
6. Mortar color, 12" long cured sample.

1.3 QUALITY ASSURANCE

- 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.
- C. Masonry Standard: Comply with ACI 530.1/ASCE 6/TMS 602 unless modified by requirements in the Contract Documents.
- D. Sample Panels: Build sample panels to verify selections made under sample submittals and to demonstrate aesthetic effects for materials. At minimum, provide:
 1. Build three mockups for typical exterior wall minimum 4 bricks wide by 6 bricks high to evaluate brick and mortar color combinations.
 2. Mockup three different mortar colors as selected by Architect.
- E. Sample Wall Construction: Erect in place mock up using materials, specified bonding patterns, and joint tooling required for final work and including cavity wall, anchors and reinforcement as detailed. Build in place mock up, 10' x 10' minimum size, as indicated on drawings, as directed by Architect, indicating the proposed range of colors, textures and workmanship to be expected in the completed work.

1.4 DELIVERY, STORAGE, AND HANDLING

- A. Store masonry units on elevated platforms in a dry location. If units are not stored in an enclosed location, cover tops and sides of stacks with waterproof sheeting, securely tied. If units become wet, do not install until they are dry.
- B. Deliver preblended, dry mortar mix in moisture-resistant containers. Store preblended, dry mortar mix in delivery containers on elevated platforms, under cover, and in a dry

location or in covered weatherproof dispensing silos.

- C. Store masonry accessories, including metal items, to prevent corrosion and accumulation of dirt and oil.

1.5 PROJECT CONDITIONS

- A. Protection of Masonry: During construction, cover tops of walls, projections, and sills with waterproof sheeting at end of each day's work. Cover partially completed masonry when construction is not in progress.
 - 1. Extend cover a minimum of 24 inches (600 mm) down both sides of walls and hold cover securely in place.
- B. Stain Prevention: Prevent grout, mortar, and soil from staining the face of masonry to be left exposed or painted. Immediately remove grout, mortar, and soil that come in contact with such masonry.
 - 1. Protect base of walls from rain-splashed mud and from mortar splatter by spreading coverings on ground and over wall surface.
 - 2. Protect sills, ledges, and projections from mortar droppings.
 - 3. Protect surfaces of window and door frames, as well as similar products with painted and integral finishes, from mortar droppings.
 - 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.
- C. Cold-Weather Requirements: Do not use frozen materials or materials mixed or coated with ice or frost. Do not build on frozen substrates. Remove and replace unit masonry damaged by frost or by freezing conditions. Comply with cold-weather construction requirements contained in ACI 530.1/ASCE 6/TMS 602.
 - 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.
- D. Hot-Weather Requirements: Comply with hot-weather construction requirements contained in ACI 530.1/ASCE 6/TMS 602.

PART 2 - PRODUCTS

2.1 MASONRY UNITS, GENERAL

- A. Defective Units: Referenced masonry unit standards may allow a certain percentage of units to contain chips, cracks, or other defects exceeding limits stated in the standard. Do not use units where such defects will be exposed in the completed Work.

2.2 BRICK

- A. General: Provide shapes indicated and as follows, with exposed surfaces matching

finish and color of exposed faces of adjacent units:

1. For ends of sills and caps and for similar applications that would otherwise expose unfinished brick surfaces, provide units without cores or frogs and with exposed surfaces finished.
 2. Provide special shapes for applications where stretcher units cannot accommodate special conditions, including those at corners, movement joints, bond beams, sashes, and lintels.
 3. Provide special shapes for applications requiring brick of size, form, color, and texture on exposed surfaces that cannot be produced by sawing.
 4. Provide special shapes for applications where shapes produced by sawing would result in sawed surfaces being exposed to view.
- B. Face and Accent Brick: Facing brick complying with ASTM C 216 or hollow brick complying with ASTM C 652, Class H40V (void areas between 25 and 40 percent of gross cross-sectional area).
1. Products: Provide the following:
 - a. Manufacturer: Endicott
 - b. Size: Norman
 - c. Color/Texture: Dark Ironspot Smooth
 2. Grade: SW.
 3. Type: FBS.
 4. Additional Requirements:
 - a. Under no circumstances may the saturation coefficient requirements of ASTM C 216, Table 1 Physical Requirements be waived.
 - b. The minimum compressive strength of an individual brick shall be 34.5 MPa (5000 psi).
 - c. Brick shall pass the freezing and thawing test as described in ASTM C 67.
 - d. Brick shall pass the efflorescence test as "not effloresced" as described in ASTM C 67.
 5. Initial Rate of Absorption: Less than 30 g/30 sq. in. (30 g/194 sq. cm) per minute when tested per ASTM C 67.
 6. Efflorescence: Provide brick that has been tested according to ASTM C 67 and is rated "not effloresced."
 7. Size (Actual Dimensions): 3-5/8 inches (92 mm) wide by 2-1/4 inches (57 mm) high by 11-5/8 inches (295 mm) long.
 8. Mortar Joints: 3/8" Raked Joint to be reviewed in mock up.

2.3 CONCRETE MASONRY UNITS (CMU'S)

- A. CMU: Provide moisture-controlled, normal weight, load bearing units of Portland cement, water, sand, and gravel. Provide hollow and/or solid configurations as indicated, and conforming to ASTM C90. Provide concrete masonry units with following characteristics:

1. Moisture Content: \leq 35 percent of total absorption in accordance with ASTM C140.
 2. Residual Linear Shrinkage: \leq 0.01 percent when dried to equilibrium of 50 percent relative humidity at 73 deg F ambient temperature.
 3. Provide block exposed in finished Work with uniform color and uniform medium-fine texture.
 - a. Manufacture units in a single run, uninterrupted except at ends of normal working days, to assure uniformity of color and texture.
 - b. Moderate "manufacturing range" of variation in color and texture will be permitted, but such variations shall not exceed those shown on approved sample panels.
 4. Size: Provide units 8 by 16 inch nominal face size, and of indicated nominal thicknesses including 4 inch, 6 inch, 8 inch, 10 inch, and 12 inch.
 5. Provide special shapes of each type of block as required to complete Work as indicated at no additional cost to Owner.
 - a. Carefully review Drawings to determine scope and varieties of special block shapes required.
 - b. Provide lip stretcher block 100 percent solid.
 - c. Provide 2 inch solid concrete soaps as necessary.
 6. Faces of units exposed in finished Work shall be handled and stored with extreme care to prevent chipping or marring.
 - a. Chipped or otherwise damaged faces will not be permitted in exposed Work.
 7. Provide half-blocks, other special blocks, and required special cutting.
 - a. Provide jamb blocks, end blocks, control joint blocks, and lintel blocks with exposed ends closed.
- B. Ground Face Units: Provide standard aggregate, highly polished ground face units. Refer to Drawing A-443 for block sizes and types. Provide color(s) as selected by Architect from manufacturer's standard choices.
1. Acceptable Manufacturers:
 - a. Basis of Design: Echelon Trendstone Trenwyth High Polish.
 - b. Spectra Development Corp.
 - c. Premier Block Corporation.
 2. Provide manufacturer's standard acrylic sealer conforming to ASTM C744.
- C. Defective Units: Referenced masonry unit standards may allow a certain percentage of units to exceed tolerances and to contain chips, cracks, or other defects exceeding limits stated in the standard. Do not use units where such defects, including dimensions that vary from specified dimensions by more than stated tolerances, will be exposed in the completed Work or will impair the quality of completed masonry.

2.4 CAST STONE (CON-09)

- A. Architectural Cast Stone: High density concrete; designed by manufacturer to achieve specified strength, color, and texture, desired handling characteristics, and to resist effects of temperature changes. Design concrete mix to achieve specified requirements

and submit specified samples.

1. Sizes / Types of Units: Refer to Drawings.
2. Compressive Strength: 5000 psi, minimum, at 28 days, when tested in accordance with ASTM C 39 using specimens made in accordance with ASTM C 31, determined by average of 3 specimens.
3. Water Absorption: 3% to 8%, maximum, when tested in accordance with ASTM C 642.
4. Weather Resistance: Mix design proven by experience to be resistant to degradation by weather.
5. Reinforcing: Cross-section amounting to at least 1/4 of 1 percent of the cross-sectional area of the unit; if unit is more than 12 inches in any dimension, provide reinforcement in both directions to resist effects of temperature variations; minimum cover of concrete equal to two times reinforcing diameter; see drawings for additional requirements.
6. Color and Texture: As selected by Architect to match CON-04, when viewed with unaided eye in good typical lighting at distance of 10 feet. No obvious repairs or chips when viewed at distance of 20 feet.
7. Pigment: Achieve desired color using only cement and aggregate to extent possible; if pigment is required, limit quantity to 10 percent by weight of cement.
8. Fabricate units with sharp arrises and accurately reproduced details, with indicated texture on all exposed surfaces unless otherwise indicated.
 - a. Slope exposed horizontal surfaces 1:12 to drain unless otherwise indicated.
 - b. Provide raised fillets at backs of sills and at ends indicated to be built into jambs.
 - c. Provide drips on projecting elements unless otherwise indicated.
9. Acid etch units after curing to remove cement film from surfaces to be exposed to view.
10. Variation in Panel Height and Width from Dimensions Indicated on Drawings: Plus 1/16 inch and minus 1/8 inch, maximum.
11. Variation in Panel Length from Dimensions Indicated on Drawings:
 - a. Length up to 24 inches: Plus 1/16 inch and minus 1/8 inch, maximum.
 - b. Length 24 to 60 inches: Plus and minus 1/8 inch, maximum.
 - c. Length 60 to 120 inches: Plus 1/8 inch and minus 3/16 inch, maximum.

B. Materials

1. Cement: ASTM C 150 Type I or II white Portland cement.
2. Fine Aggregate: Carefully graded and washed natural sand, or manufactured granite, quartz, or limestone sand, complying with ASTM C 33 with the exception that gradation may vary to achieve desired finish and texture.
3. Coarse Aggregate: Carefully graded and washed natural gravel, or crushed graded stone such as granite, quartz, limestone, or other durable stone, complying with ASTM C 33 with the exception that gradation may vary to achieve desired finish and texture.
4. Pigments: Inorganic, natural or synthetic iron oxide pigments complying with ASTM C 979 and guaranteed by manufacturer to be lime proof. Exception: Cement grade carbon black pigment is permitted.

5. Reinforcing: As indicated on drawings and as required by design.
 - a. Units Exposed to Weather: Provide galvanized or epoxy coating on reinforcing 5/8 inch in diameter or less unless covered by at least 2 inches of concrete.
 - b. Bars: ASTM A 615 Grade 40 or 60.
 - c. Wire Reinforcement: ASTM A 82.
 - d. Welded Wire Fabric: ASTM A 185 or A 497.
 - e. Bar Mats: ASTM A 184/A 184M.
6. Setting Mortar: Type S, non-staining.
7. Pointing Mortar: 1 part ASTM C 91 cement, 1 part ASTM C 207 Type S hydrated lime, 4 parts clean washed sand.
8. Setting Anchors: Commercially available stone anchors, dowels, inserts and other anchoring devices; made of zinc alloy, hot-dipped galvanized steel, brass, or Type 302 or 304 stainless steel.
9. Joint Sealer and Accessory Materials: As specified in Section 079200.

2.5 MORTAR AND GROUT MATERIALS

- A. Regional Materials: Provide aggregate for mortar and grout, cement, and lime that have been extracted, harvested, or recovered, as well as manufactured, within 500 miles (800 km) of Project site.
 - B. Portland Cement: ASTM C 150, Type I or II, except Type III may be used for cold-weather construction. Provide natural color or white cement as required to produce mortar color indicated.
 - C. Hydrated Lime: ASTM C 207, Type S.
 - D. Portland Cement-Lime Mix: Packaged blend of portland cement and hydrated lime containing no other ingredients.
 - E. Masonry Cement: ASTM C 91.
 - F. Mortar Cement: ASTM C 1329.
 - G. Colored Cement Product: Packaged blend made from masonry cement or mortar cement and mortar pigments, all complying with specified requirements, and containing no other ingredients.
1. Products: Available products that may be incorporated into the Work include the following:
 - a. Capital Materials Corporation; Flamingo Color Masonry Cement.
 - b. Cemex S.A.B. de C.V.; Richcolor Masonry Cement.
 - c. Essroc, Italcementi Group; Brixment-in-Color.
 - d. Holcim (US) Inc.; Rainbow Mortamix Custom Color Masonry Cement.
 - e. Lafarge North America Inc.; U.S. Cement Custom Color Masonry Cement.
 - f. Lehigh Cement Company; Lehigh Custom Color Masonry Cement.
 - g. National Cement Company, Inc.; Coosa Masonry Cement.

2. Formulate blend as required to produce color indicated or, if not indicated, as selected from manufacturer's standard colors.
3. Pigments shall not exceed 5 percent of masonry cement or mortar cement by weight.
4. Architect to select mortar color from manufacturer's standard colors.

H. 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 (6 mm) thick, use aggregate graded with 100 percent passing the No. 16 (1.18-mm) sieve.
3. White-Mortar Aggregates: Natural white sand or crushed white stone.
4. Colored-Mortar Aggregates: Natural sand or crushed stone of color necessary to produce required mortar color.

I. Aggregate for Grout: ASTM C 404.

J. Cold-Weather Admixture: Non-chloride, noncorrosive, accelerating admixture complying with ASTM C 494 (C 494M), Type C, and recommended by manufacturer for use in masonry mortar of composition indicated.

1. Products: Available products that may be incorporated into the Work include the following:
 - a. Euclid Chemical Company (The); Accelguard 80.
 - b. Grace Construction Products, W. R. Grace & Co. - Conn.; Morset.
 - c. Sonneborn Products, BASF Aktiengesellschaft; Trimix-NCA.

K. Water: Potable.

2.6 REINFORCEMENT

A. Masonry Joint Reinforcement, General: ASTM A 951 (A 951M).

1. Exterior Walls: Hot-dip galvanized, carbon steel.
2. Wire Size for Side Rods: 0.148-inch (3.77-mm) diameter.
3. Wire Size for Cross Rods: 0.148-inch (3.77-mm) diameter.
4. Wire Size for Veneer Ties: 0.148-inch (3.77-mm) diameter.
5. Spacing of Cross Rods, Tabs, and Cross Ties: Not more than 16 inches (407 mm) on center.
6. Provide in lengths of not less than 10 feet (3 m), with prefabricated corner and tee units.

B. Masonry Joint Reinforcement for Single-Wythe Masonry: Either ladder or truss type with single pair of side rods.

2.7 TIES AND ANCHORS

- A. Manufacturers: Provide products of one of the following, or acceptable equivalent:
 - 1. Halfen Anchoring Systems; Meadow-Burke.
 - 2. Heckmann Building Products Inc.
 - 3. Hohmann & Barnard, Inc.
- B. Materials: Provide ties and anchors specified in this article that are made from materials that comply with the following unless otherwise indicated.
 - 1. Hot-Dip Galvanized, Carbon-Steel Wire: ASTM A1064; with ASTM A 153 Class B-2 coating.
 - 2. Steel Sheet, Galvanized after Fabrication: ASTM A 1008, Commercial Steel, with ASTM A 153, Class B coating.
 - 3. Steel Plates, Shapes, and Bars: ASTM A 36.
 - 4. Wire: Fabricate from 1/4-inch diameter wire.
- C. Adjustable Masonry-Veneer Anchors:
 - 1. General: Provide anchors that allow vertical adjustment but resist tension and compression forces perpendicular to plane of wall, for attachment over sheathing to wood or metal studs, and as follows:
 - a. Structural Performance Characteristics: Capable of withstanding a 100-lbf (445-N) load in both tension and compression without deforming or developing play in excess of 0.05 inch (1.3 mm).
 - 2. Thermally Broken Masonry Ties: Single screw veneer tie for metal stud construction with dual-diameter barrel with factory-installed EPDM washers to seal both the face of the insulation and the air/vapor barrier, equal to Hohmann & Barnard Thermal 2-Seal Tie.
 - 3. Stainless-Steel Drill Screws for Steel Studs: Proprietary fastener consisting of carbon-steel drill point and 300 Series stainless-steel shank, complying with ASTM C 954 except manufactured with hex washer head and neoprene or EPDM washer, No. 10 (4.83-mm) diameter by length required to penetrate steel stud flange with not less than three exposed threads.

2.8 EMBEDDED FLASHING

- A. General: Provide one of the following flashing systems as indicated on the Drawings or required for a complete installation. Flashing materials shall be compatible with and integrated into the air barrier system specified in Section 072726.
- B. Metal Flashing: Provide metal flashing complying with SMACNA's "Architectural Sheet Metal Manual" and as follows:
 - 1. Stainless Steel: ASTM A 240 or ASTM A 666, Type 304, 0.016 inch thick.
 - 2. Fabricate continuous flashings in sections 96 inches long minimum, but not exceeding 12 feet. Provide splice plates at joints of formed, smooth metal flashing.
 - 3. Fabricate metal drip edges from stainless steel. Extend at least 3 inches into wall

- and 1/2 inch out from wall, with outer edge bent down 30 degrees and hemmed.
4. Solder metal items at corners.
 5. Provide preformed stainless steel end dams at all flashing terminations at openings
- C. Stainless Steel Flashing Drainage System: Engineered laminate composite of stainless steel, polymer fabric and non-woven drainage fabric.
1. Stainless Steel metal core flexible flashing with drainage fabric:
 - a. Basis of Design: York Manufacturing, Inc.; York Flash-Vent SS. Provide this product, or one of the following:
 - 1). STS Coatings, Inc.; Wall Guardian TWF Stainless Steel
 - 2). Acceptable equivalent.
 - b. Characteristics:
 - 1). Type: Engineered system, with high resistant to damage, composite with a stainless steel core with non-asphalt adhesive polymer fabric laminated to one stainless steel face and non-woven drainage fabric laminated to opposing face with non-asphalt adhesive.
 - 2). Stainless steel: ASTM A167
 - 3). Fabrics:
 - a). Polymer fabric; laminated back face to metal core.
 - b). Non-woven drainage fabric: Fabric laminated to front face metal core.
 - c). Size: Manufacturer's standard width rolls.
- D. Flashing Accessories
1. Mastic/sealant: Product standard of quality is York Manufacturing, Inc.; UniverSeal US100.
 - a. Characteristics:
 - 1). Type: One part 100% solids, solvent-free formulated silyl-terminated polyether (STPE), ASTM C920-11, Type S, Grade NS, Class 50.
 2. Outside corner and inside corner material; manufacturer's standard available units using:
 - a. Stainless steel: 26 gauge stainless steel.
 3. End dam: Product may be folded in line with the flashing material or utilize preformed end dams by manufacturer using:
 - a. Stainless steel: 26 gauge stainless steel
 4. Splice material: Product standard of quality is York 304 by York Manufacturing, standard self-adhered metal material; material matching system material or use York Manufacturing's Multi-Flash Stainless Steel lap piece and polyether sealant as a splice.
 5. Termination bar: Product standard of quality is York T-96 termination bar. Manufacturer's standard 1 in. composite material bar or a 1 in. 26 gauge stainless steel termination bar with sealant lip.
 6. Weep vent protection: Product standard of quality is York's Weep Armor. Geotextile drainage fabric at least 12 in. in height.
 7. Repair and other materials/accessories: Manufacturer's standard.

8. Fasteners: Domestic manufactured fastener types and sizes recommended by flashing manufacturer for intended use.

2.9 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 neoprene, 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, organic roofing felt complying with ASTM D 226, Type I (No. 15 asphalt felt).
- D. Cavity Drainage Material: Free-draining mesh, made from polymer strands that will not degrade within the wall cavity.
 1. Products: Provide the following:
 - a. Archovations, Inc.; CavClear Masonry Mat.
 - b. Mortar Net USA, Ltd.; Mortar Net.
 - c. H&B Mortar Trap.
 - d. Heckmann Wall Defender.
 2. Provide one of the following configurations:
 - 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.
 - b. Sheets or strips not less than 1 inch (25 mm) thick and installed to full height of cavity with additional strips 4 inches (100 mm) high at weep holes and thick enough to fill entire depth of cavity and prevent weep holes from clogging with mortar.
- E. Mesh Weep/Vent: Free-draining mesh; made from polyethylene strands, full height and width of head joint and depth 1/8 inch (3 mm) less than depth of outer wythe; in color selected from manufacturer's standard.
 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Advanced Building Products Inc.
 - b. CavClear/Archovations, Inc.
 - c. Keene Building Products.
 - d. Mortar Net USA, Ltd.
- F. Reinforcing Bar Positioners: Wire units designed to fit into mortar bed joints spanning masonry unit cells and hold reinforcing bars in center of cells. Units are formed from 0.148-inch (3.77-mm) steel wire, hot-dip galvanized after fabrication. Provide units designed for number of bars indicated.

2.10 CAVITY-WALL INSULATION

- A. Mineral Wool as specified in Section 072100.

2.11 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: Available manufacturers offering products that may be incorporated into the Work include the following:
 - a. Diedrich Technologies, Inc.
 - b. EaCo Chem, Inc.
 - c. ProSoCo, Inc.

2.12 MORTAR AND GROUT MIXES

- A. General: Do not use admixtures, including pigments, air-entraining agents, accelerators, retarders, water-repellent agents, antifreeze compounds, or other admixtures, unless otherwise indicated.
 - 1. Do not use calcium chloride in mortar or grout.
 - 2. For exterior masonry, use portland cement-lime mortar.
 - 3. 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 exterior brick masonry, use Type S.
- D. Pigmented Mortar: Use colored cement product or select and proportion pigments with other ingredients to produce color required. Do not add pigments to colored cement products.
 - 1. Manufacturers:
 - a. Workrite Mortars, Davis Colors, Lehigh Cement
 - 2. Pigments shall not exceed 10 percent of portland cement by weight.
 - 3. Pigments shall not exceed 5 percent of masonry cement or mortar cement by weight.
 - 4. Mix to match Architect's sample.

- E. Colored-Aggregate Mortar: Produce required mortar color by using colored aggregates and natural color or white cement as necessary to produce required mortar color.
 - 1. Mix to match Architect's sample.
- F. 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 Table 1.15.1 in ACI 530.1/ASCE 6/TMS 602 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 (14 MPa).
 - 3. Provide grout with as slump required 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 work.
 - 2. Verify that foundations are within tolerances specified.
 - 3. Verify that reinforcing dowels are properly placed.
- B. Before installation, examine rough-in and built-in construction for piping systems to verify actual locations of piping connections.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION, GENERAL

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

- E. Select and arrange units for exposed unit masonry to produce a uniform blend of colors and textures.
 - 1. Mix units from several pallets or cubes as they are placed.

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 (12 mm) or minus 1/4 inch (6 mm).
- 2. For location of elements in plan do not vary from that indicated by more than plus or minus 1/2 inch (12 mm).
- 3. For location of elements in elevation do not vary from that indicated by more than plus or minus 1/4 inch (6 mm) in a story height or 1/2 inch (12 mm) 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 (6 mm in 3 m), or 1/2 inch (12 mm) 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 (3 mm in 3 m), 1/4 inch in 20 feet (6 mm in 6 m), or 1/2 inch (12 mm) maximum.
- 3. For vertical lines and surfaces do not vary from plumb by more than 1/4 inch in 10 feet (6 mm in 3 m), 3/8 inch in 20 feet (9 mm in 6 m), or 1/2 inch (12 mm) 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 (3 mm in 3 m), 1/4 inch in 20 feet (6 mm in 6 m), or 1/2 inch (12 mm) maximum.
- 5. For lines and surfaces do not vary from straight by more than 1/4 inch in 10 feet (6 mm in 3 m), 3/8 inch in 20 feet (9 mm in 6 m), or 1/2 inch (12 mm) maximum.
- 6. For vertical alignment of exposed head joints, do not vary from plumb by more than 1/4 inch in 10 feet (6 mm in 3 m), or 1/2 inch (12 mm) maximum.
- 7. For faces of adjacent exposed masonry units, do not vary from flush alignment by more than 1/16 inch (1.5 mm) 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 (3 mm), with a maximum thickness limited to 1/2 inch (12 mm).
- 2. For exposed bed joints, do not vary from bed-joint thickness of adjacent courses by more than 1/8 inch (3 mm).
- 3. For head and collar joints, do not vary from thickness indicated by more than plus 3/8 inch (9 mm) or minus 1/4 inch (6 mm).
- 4. For exposed head joints, do not vary from thickness indicated by more than plus or minus 1/8 inch (3 mm). Do not vary from adjacent bed-joint and head-joint thicknesses by more than 1/8 inch (3 mm).
- 5. For exposed bed joints, do not vary from a straight line by more than 1/16 inch (1.5

mm) 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 Face Brick Masonry: Lay exposed masonry in bond indicated on Drawings; do not use units with less than nominal 4-inch (100-mm) horizontal face dimensions at corners or jambs.
- C. Stopping and Resuming Work: Stop work by racking back units in each course from those in course below; do not tooth. When resuming work, clean masonry surfaces that are to receive mortar, remove loose masonry units and mortar, and wet brick if required before laying fresh masonry.
- D. Built-in Work: As construction progresses, build in items specified in this and other Sections. Fill in solidly with masonry around built-in items.

3.5 MORTAR BEDDING AND JOINTING

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

3.6 CAVITY WALLS

- A. Bond wythes of cavity walls together using one of the following methods:
 - 1. Individual Metal Ties: Provide not less than one metal tie for 2 sq. ft. of wall area spaced not to exceed 16 inches o.c. horizontally and 16 inches o.c. vertically.
 - a. Where bed joints of wythes do not align, use adjustable (two-piece) type ties.
 - b. Where one wythe is of clay masonry and the other of concrete masonry, use adjustable (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 (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 (two-piece) type reinforcement with continuous horizontal wire in facing wythe attached to ties to allow for differential movement regardless of whether bed joints align.
3. 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.
- 1. Insulated.
 - a. Provide a cavity a minimum of 3-1/2 inches wide, composed of a nominal 1-1/2 inch cavity and 2 inches of cavity wall insulation, unless otherwise indicated, to separate facing and backing. Bond facing and masonry backing together with horizontal wall reinforcement or adjustable ties.
 - b. Adhere cavity wall insulation to wall surface without back voids and with tightly butted joints and with vertical joints staggered. Install cavity wall insulation full height of wall against inner wythe between ties, leaving 2 inch (50-mm) minimum cavity between insulation and outer wythe. All joints shall be taped.

3.7 MASONRY JOINT REINFORCEMENT

- A. General: Install entire length of longitudinal side rods in mortar with a minimum cover of 5/8 inch (16 mm) on exterior side of walls, 1/2 inch (13 mm) elsewhere. Lap reinforcement a minimum of 6 inches (150 mm).
 - 1. Space reinforcement not more than 16 inches (406 mm) on center.
 - 2. Provide reinforcement not more than 8 inches (203 mm) above and below wall openings and extending 12 inches (305 mm) beyond openings in addition to continuous reinforcement.
- B. Interrupt joint reinforcement at control and expansion joints unless otherwise indicated.
- C. Provide continuity at corners by using prefabricated L-shaped units.
- D. Cut and bend reinforcing units as directed by manufacturer for continuity at corners, returns, offsets, pipe enclosures, and other special conditions.

3.8 CONTROL AND EXPANSION JOINTS

- A. General: Install control and expansion joint materials in unit masonry as masonry progresses. Do not allow materials to span control and expansion joints without provision to allow for in-plane wall or partition movement.
 - 1. Brick Veneer Expansion Joint Spacing: As shown on Drawings.

B. Form expansion joints in brick as follows:

1. Build flanges of factory-fabricated, expansion-joint units into masonry.
2. Build in compressible joint fillers where indicated.
3. Form open joint full depth of brick wythe and of width indicated, but not less than 1/2 inch (13 mm) for installation of sealant and backer rod specified in Section 079200 - JOINT SEALANTS.

3.9 FLASHING, WEEP HOLES, CAVITY DRAINAGE, AND 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. Install vents at shelf angles, ledges, and other obstructions to upward flow of air in cavities, 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. Before covering with mortar, seal penetrations in flashing with adhesive, sealant, or tape as recommended by flashing manufacturer.
2. Install where indicated, specified, or required in accord with flashing manufacturer's written instructions and as follows.
 - a. Prohibited practice: Tucking the flashing into the backer wall.
 - b. Prohibited practice: Bonding or splicing to non-woven drainage fabric.
3. Extend flashing 6 in. minimum, beyond opening, each side without stretching flashing material. Fold flashing ends at end of openings or horizontal flashing terminations to form end dam or use preformed end dams from manufacturer.
4. Flashing width: Width required starting 1.5 in. to the exterior of the outside face of exterior wythe, extending through cavity, rising height required to extend above lintel steel at least 2 in. After inspection by the agreed upon parties the flashing should be cut flush with the leading edge of the brick.
5. Splice end joints by butting ends together over 4 in. wide piece of self-adhering stainless steel flashing. The self-adhering stainless steel flashing should be sealed metal face down on to the substrate with the mastic. Remove the release linear and butt the two piece of flashing together and embed them into the splice sealant. Then seal the butt seam with sealant.
6. Masonry back up:
 - a. Surface mount flashing after damp proofing installation specified in Damp Proofing Section in accord with manufacturer's installation instructions.
 - b. Apply flashing with drainage surface to outside.
 - c. Fasten the top of the flashings to the backup wall with a non-corrosive termination bar and seal the top edge with a compatible sealant.
7. Concrete back up:
 - a. Surface mount flashing after damp proofing installation specified in Damp Proofing Section in accord with manufacturer's installation instructions.
 - b. Apply flashing with drainage surface to outside.

- c. Fasten the top of the flashings to the backup wall with a non-corrosive termination bar and seal the top edge with a compatible sealant.
 - 8. Stud back up with sheathing:
 - a. Surface mount flashing after certified compatible damp proofing installation specified in Damp Proofing Section in accord with manufacturer's installation instructions
 - b. Apply flashing with drainage surface to the outside.
 - c. Fasten the top of the flashings to the backup wall with a non-corrosive termination bar and seal the top edge with a compatible sealant.
 - 9. Confirm compatibility with manufacturer's mutual letters for all lapping components, Air barrier installation lapping over flashing top in the Air Barrier Section.
 - 10. Lay flashing in continuous bead of sealant on masonry supporting steel.
 - 11. Fold ends of flashing at end of opening to form dam; seal with sealant or utilize preformed end dams from manufacturer.
 - 12. Inside corners: Make in manufacturers accepted manner using corner and splice material or utilize preformed corners from manufacturer.
 - 13. Outside corners: Make in manufacturers accepted manner using corner and splice material or utilize preformed corners from manufacturer.
 - 14. Do not coat the entire drainage fabric with air barrier. Leave the drainage fabric exposed at least an inch over the top of the mortar droppings.
 - 15. Weep vent protection use the geotextile drainage and install it on the third row height of standard bricks to have the fabric reach the base of the flashing and covering the weep vents.
 - 16. Cover flashing within a few days of installation to protect it from damage from the different trades, the environment and falling debris. If flashing is left unprotected and it is punctured, torn, or has loose scrim you should contact the manufacturer for repair instructions.
- 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 head joints in exterior wythes of first course of masonry immediately above embedded flashing and as follows:
- 1. Use open head joints to form weep holes.
 - 2. Space weep holes 24 inches (600 mm) on center unless otherwise indicated.
- E. Place cavity drainage material in cavities to comply with configuration requirements for cavity drainage material in "Miscellaneous Masonry Accessories" Article.

3.10 FIELD QUALITY CONTROL

- A. Testing and Inspecting: Architect 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. Inspections: Level B special inspections according to the "International Building Code."

1. Begin masonry construction only after inspectors have verified proportions of site-prepared mortar.
 2. Place grout only after inspectors have verified compliance of grout spaces and of grades, sizes, and locations of reinforcement.
 3. Place grout only after inspectors have verified proportions of site-prepared grout.
- C. Testing Prior to Construction: One set of tests.
- D. Testing Frequency: One set of tests for each 5000 sq. ft. (464 sq. m) of wall area or portion thereof.

3.11 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.
 3. Protect adjacent 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 masonry with a proprietary acidic cleaner applied according to manufacturer's written instructions.

3.12 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.

3.13 WASTE MANAGEMENT

- A. Separate and dispose of waste in accordance with the Project's Waste Management Plan.

END OF SECTION

SECTION 051200 - STRUCTURAL STEEL FRAMING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. This Section includes the following:
 - 1. Structural steel.
 - 2. Grout.
- B. Related Sections include the following:
 - 1. Division 01 Section "Quality Requirements" for independent testing agency procedures and administrative requirements.
 - 2. Division 05 Section "Steel Decking" for field installation of shear connectors.
 - 3. Division 05 Section "Metal Fabrications" for miscellaneous steel fabrications and other metal items not defined as structural steel.
 - 4. Specification Section 051213 Architecturally Exposed Structural Steel.
 - 5. Specification Section 099600 High Performance Coatings.

1.3 DEFINITIONS

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

1.4 PERFORMANCE REQUIREMENTS

- A. Connections: Provide details of connections required by the Contract Documents to be selected or completed by structural-steel fabricator to withstand service loads indicated and comply with other information and restrictions indicated.
 - 1. Select and complete connections using AISC's "Manual of Steel Construction", Part 10.
 - 2. Engineering Responsibility: Fabricator's responsibilities include using a qualified professional engineer to prepare structural analysis data for structural-steel connections.
 - 3. All calculations shall be signed and sealed by a registered professional engineer in North Carolina.
 - 4. Calculations shall also include but not be limited to the following:
 - a. Doubler plates for columns.
 - b. Stiffener plates for columns and beams.
 - c. All beam to column connections.
 - d. All beam to beam connections.
 - e. All vertical frame connections.

- f. Moment connections. If moments are not indicated, fabricator shall design beam to column connection for full moment capacity of beam.

B. Construction: Type FR, fully restrained.

1.5 SUBMITTALS

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

B. Shop Drawings: Show fabrication of structural-steel components.

- 1. Include details of cuts, connections, splices, camber, holes, and other pertinent data.
- 2. Include embedment drawings.
- 3. Indicate welds by standard AWS symbols, distinguishing between shop and field welds, and show size, length, and type of each weld.
- 4. Indicate type, size, and length of bolts, distinguishing between shop and field bolts. Identify pretensioned and slip-critical high-strength bolted connections.
- 5. For structural-steel connections indicated to comply with design loads, include structural analysis data signed and sealed by the qualified professional engineer responsible for their preparation.
- 6. Provide letter from delegated design engineer licensed in the state of North Carolina stating that they have reviewed the structural steel shop drawings and the connections are consistent with their calculations and intent. See also Structural General Note #7 on Sheet S001.

C. Welding certificates.

D. Qualification Data: For fabricator.

E. Mill Test Reports: Signed by manufacturers certifying that the following products comply with requirements:

- 1. Structural steel including chemical and physical properties.
- 2. Bolts, nuts, and washers including mechanical properties and chemical analysis.

1.6 QUALITY ASSURANCE

A. Installer Qualifications: A qualified installer who participates in the AISC Quality Certification Program and is designated an AISC-Certified Erector, Category CSE.

B. Fabricator Qualifications: A qualified fabricator who participates in the AISC Quality Certification Program and is designated an AISC-Certified Plant, Category Sbd.

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

D. Comply with applicable provisions of the following specifications and documents:

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

- E. Preinstallation Conference: Conduct conference at Project site to comply with requirements in Division 01 Section "Project Management and Coordination."

1.7 DELIVERY, STORAGE, AND HANDLING

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

1.8 COORDINATION

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

PART 2 - PRODUCTS

2.1 STRUCTURAL-STEEL MATERIALS

- A. Recycled Content of Steel Products: Postconsumer recycled content plus one-half of preconsumer recycled content not less than 50 percent.
- B. W-Shapes: ASTM A 992.
- C. Channels, Angles: ASTM A 36.
- D. Plate and Bar: ASTM A 572, Grade 50 or ASTM A 36.
- E. Cold-Formed Hollow Structural Sections: ASTM A 500, Grade B, structural tubing.
- F. Steel Pipe: ASTM A 53, Type E or S, Grade B.
 - 1. Weight Class: As indicated.
 - 2. Finish: Black, except where indicated to be galvanized.
- G. Welding Electrodes: Comply with AWS requirements.
- H. All structural steel in exterior locations (cornices, parapets, hand rails, guard rails, canopies, etc.) are to be hot dip galvanized.

2.2 BOLTS, CONNECTORS, AND ANCHORS

- A. High-Strength Bolts, Nuts, and Washers: ASTM A 325, Type 1, heavy hex steel structural bolts; ASTM A 563 heavy hex carbon-steel nuts; and ASTM F 436 hardened carbon-steel washers.

1. Finish: Plain.
- B. High-Strength Bolts, Nuts, and Washers: ASTM A 490, Type 1, heavy hex steel structural bolts; ASTM A 563 heavy hex carbon-steel nuts; and ASTM F 436 hardened carbon-steel washers, plain.
- C. Tension-Control, High-Strength Bolt-Nut-Washer Assemblies: ASTM F 1852, Type 1, round head steel structural bolts with splined ends; ASTM A 563 heavy hex carbon-steel nuts; and ASTM F 436 hardened carbon-steel washers.
 1. Finish: Plain.
- D. Shear Connectors: ASTM A 108, Grades 1015 through 1020, headed-stud type, cold-finished carbon steel; AWS D1.1, Type B.
- E. Unheaded Anchor Rods: ASTM F 1554, Grade 36.
 1. Configuration: Straight.
 2. Nuts: ASTM A 563 heavy hex carbon steel.
 3. Plate Washers: ASTM A 36 carbon steel.
 4. Washers: ASTM F 436 hardened carbon steel.
 5. Finish: Plain or hot-dip zinc coating, ASTM A 153, Class C as indicated.
- F. Unheaded Anchor Rods: ASTM F 1554, Grade 55.
 1. Configuration: Straight.
 2. Nuts: ASTM A 563 heavy hex carbon steel.
 3. Plate Washers: ASTM A 36 carbon steel.
 4. Washers: ASTM F 436 hardened carbon steel.
 5. Finish: Plain or hot-dip zinc coating, ASTM A 153, Class C as indicated.
- G. Unheaded Anchor Rods: ASTM F 1554, Grade 105.
 1. Configuration: Straight.
 2. Nuts: ASTM A 563 heavy hex carbon steel.
 3. Washers: ASTM F 436 hardened carbon steel.
 4. Finish: Plain or hot-dip zinc coating, ASTM A 153, Class C as indicated.
- H. Headed Anchor Rods/Thru Bolts: ASTM A 307, Grade A, straight.
 1. Nuts: ASTM A 563 heavy hex carbon steel.
 2. Plate Washers: ASTM A 36 carbon steel.
 3. Washers: ASTM F 436 hardened carbon steel.
 4. Finish: Plain or hot-dip zinc coating, ASTM A 153, Class C as indicated.
- I. Threaded Rods: ASTM A 36.
 1. Nuts: ASTM A 563 heavy hex carbon steel.
 2. Washers: ASTM A 36 carbon steel.
 3. Finish: Mechanically deposited zinc coating, ASTM B 695, Class 50.
- J. Clevises and Turnbuckles: ASTM A 108, Grade 1035, cold-finished carbon steel.
- K. Eye Bolts and Nuts: ASTM A 108, Grade 1030, cold-finished carbon steel.

- L. Sleeve Nuts: ASTM A 108, Grade 1018, cold-finished carbon steel.

2.3 PRIMER

- A. Primer: Fabricator's standard lead- and chromate-free, nonasphaltic, rust-inhibiting primer complying with MPI#79 and compatible with topcoat.
- B. Galvanizing Repair Paint: ASTM A 780/A 780M.

2.4 GROUT

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

2.5 FABRICATION

- A. Structural Steel: Fabricate and assemble in shop to greatest extent possible. Fabricate according to AISC's "Code of Standard Practice for Steel Buildings and Bridges" and AISC's "Specification for Structural Steel Buildings."
 - 1. Camber structural-steel members where indicated.
 - 2. Identify high-strength structural steel according to ASTM A 6 and maintain markings until structural steel has been erected.
 - 3. Mark and match-mark materials for field assembly.
 - 4. Complete structural-steel assemblies, including welding of units, before starting shop-priming operations.
- B. Thermal Cutting: Perform thermal cutting by machine to greatest extent possible.
 - 1. Plane thermally cut edges to be welded to comply with requirements in AWS D1.1.
- C. Bolt Holes: Cut, drill, or punch standard bolt holes perpendicular to metal surfaces.
- D. Finishing: Accurately finish ends of columns and other members transmitting bearing loads.
- E. Cleaning: Clean and prepare steel surfaces that are to remain unpainted according to SSPC-SP 2, "Hand Tool Cleaning and SSPC-SP 3, "Power Tool Cleaning."
- F. Shear Connectors: Prepare steel surfaces as recommended by manufacturer of shear connectors. Use automatic end welding of headed-stud shear connectors according to AWS D1.1 and manufacturer's written instructions.
- G. Holes: Provide holes required for securing other work to structural steel and for passage of other work through steel framing members.
 - 1. Cut, drill, or punch holes perpendicular to steel surfaces. Do not thermally cut bolt holes or enlarge holes by burning.
 - 2. Base-Plate Holes: Cut, drill, mechanically thermal cut, or punch holes perpendicular to steel surfaces.
 - 3. Weld threaded nuts to framing and other specialty items indicated to receive other work.

2.6 SHOP CONNECTIONS

- A. High-Strength Bolts: Shop install high-strength bolts according to RCSC's "Specification for Structural Joints Using ASTM A 325 or A 490 Bolts" for type of bolt and type of joint specified.
 - 1. Joint Type: Snug tightened.
- B. Weld Connections: Comply with AWS D1.1 for welding procedure specifications, tolerances, appearance, and quality of welds and for methods used in correcting welding work.
 - 1. Remove backing bars or runoff tabs, back gouge, and grind steel smooth.
 - 2. Assemble and weld built-up sections by methods that will maintain true alignment of axes without exceeding tolerances of AISC's "Code of Standard Practice for Steel Buildings and Bridges" for mill material.
 - 3. Verify that weld sizes, fabrication sequence, and equipment used for architecturally exposed structural steel will limit distortions to allowable tolerances. Prevent weld show-through on exposed steel surfaces.
 - a. Grind butt welds flush.
 - b. Grind or fill exposed fillet welds to smooth profile. Dress exposed welds.

2.7 SHOP PRIMING

- A. Shop prime steel surfaces except the following:
 - 1. Surfaces embedded in concrete or mortar. Extend priming of partially embedded members to a depth of **2 inches**.
 - 2. Surfaces to be field welded.
 - 3. Surfaces of high-strength bolted, slip-critical connections.
 - 4. Surfaces to receive sprayed fire-resistive materials (applied fireproofing).
 - 5. Galvanized surfaces.
 - 6. Surfaces enclosed in interior construction.
- B. Surface Preparation: Clean surfaces to be painted. Remove loose rust and mill scale and spatter, slag, or flux deposits. Prepare surfaces according to the following specifications and standards:
 - 1. SSPC-SP 3, "Power Tool Cleaning."
- C. Priming: Immediately after surface preparation, apply primer according to manufacturer's written instructions and at rate recommended by SSPC to provide a minimum dry film thickness of **1.5 mils**. Use priming methods that result in full coverage of joints, corners, edges, and exposed surfaces.

2.8 GALVANIZING

- A. Hot-Dip Galvanized Finish: Apply zinc coating by the hot-dip process to structural steel according to ASTM A 123/A 123M.
 - 1. Fill vent and drain holes that are exposed in the finished Work unless they function as weep holes, by plugging with zinc solder and filing off smooth.
 - 2. Galvanize lintels, shelf angles, and welded door frames attached to structural-steel frame and located in exterior walls.

2.9 SOURCE QUALITY CONTROL

- A. Engage a testing agency to perform shop tests and inspections and prepare test reports. Submit all test and inspection reports at conclusion of fabrication and prior to shipping steel.
- B. Correct deficiencies in Work that test reports and inspections indicate does not comply with the Contract Documents.
- C. Bolted Connections: Shop-bolted connections will be inspected according to RCSC's "Specification for Structural Joints Using ASTM A 325 or A 490 Bolts."
- D. Welded Connections: In addition to visual inspection, all full penetration shop-welded connections will be tested and inspected according to AWS D1.1 and the following inspection procedures, at testing agency's option:
 - 1. Liquid Penetrant Inspection: ASTM E 165.
 - 2. Magnetic Particle Inspection: ASTM E 709; performed on root pass and on finished weld. Cracks or zones of incomplete fusion or penetration will not be accepted.
 - 3. Ultrasonic Inspection: ASTM E 164.
 - 4. Radiographic Inspection: ASTM E 94.
- E. In addition to visual inspection, shop-welded shear connectors will be tested and inspected according to requirements in AWS D1.1 for stud welding and as follows:
 - 1. Bend tests will be performed if visual inspections reveal either a less-than- continuous 360-degree flash or welding repairs to any shear connector.
 - 2. Tests will be conducted on additional shear connectors if weld fracture occurs on shear connectors already tested, according to requirements in AWS D1.1.

PART 3 - EXECUTION

3.1 EXAMINATION

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

3.2 PREPARATION

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

3.3 ERECTION

- A. Set structural steel accurately in locations and to elevations indicated and according to AISC's "Code of Standard Practice for Steel Buildings and Bridges" and "Specification for Structural Steel Buildings."
- B. Base and Bearing Plates: Clean concrete- and masonry-bearing surfaces of bond-reducing materials, and roughen surfaces prior to setting base and bearing plates. Clean bottom surface of base and bearing plates.
 - 1. Set base and bearing plates for structural members on wedges, shims, or setting nuts as required.
 - 2. Weld plate washers to top of base plate as indicated.
 - 3. Snug-tighten anchor rods after supported members have been positioned and plumbed. Do not remove wedges or shims but, if protruding, cut off flush with edge of base or bearing plate before packing with grout. Pre-tension anchor bolts where indicated.
 - 4. Promptly pack grout solidly between bearing surfaces and base or bearing plates so no voids remain. Neatly finish exposed surfaces; protect grout and allow to cure. Comply with manufacturer's written installation instructions for shrinkage-resistant grouts.
- C. Maintain erection tolerances of structural steel within AISC's "Code of Standard Practice for Steel Buildings and Bridges."
- D. Align and adjust various members forming part of complete frame or structure before permanently fastening. Before assembly, clean bearing surfaces and other surfaces that will be in permanent contact with members. Perform necessary adjustments to compensate for discrepancies in elevations and alignment.
 - 1. Level and plumb individual members of structure.
 - 2. Make allowances for difference between temperature at time of erection and mean temperature when structure is completed and in service.
- E. Splice members only where indicated.
- F. Remove erection bolts on welded, exposed structural steel; fill holes with plug welds; and grind smooth at exposed surfaces.
- G. Do not use thermal cutting during erection unless approved by Engineer. Finish thermally cut sections within smoothness limits in AWS D1.1.
- H. Do not enlarge unfair holes in members by burning or using drift pins. Ream holes that must be enlarged to admit bolts.
- I. Shear Connectors: Prepare steel surfaces as recommended by manufacturer of shear connectors. Use automatic end welding of headed-stud shear connectors according to AWS D1.1 and manufacturer's written instructions.

3.4 FIELD CONNECTIONS

- A. High-Strength Bolts: Install high-strength bolts according to RCSC's "Specification for Structural Joints Using ASTM A 325 or A 490 Bolts" for type of bolt and type of joint specified.
 - 1. Joint Type: Snug tightened.

- B. Weld Connections: Comply with AWS D1.1 for welding procedure specifications, tolerances, appearance, and quality of welds and for methods used in correcting welding work.
1. Comply with AISC's "Code of Standard Practice for Steel Buildings and Bridges" and "Specification for Structural Steel Buildings" for bearing, adequacy of temporary connections, alignment, and removal of paint on surfaces adjacent to field welds.
 2. Remove backing bars or runoff tabs, back gouge, and grind steel smooth.
 3. Assemble and weld built-up sections by methods that will maintain true alignment of axes without exceeding tolerances of AISC's "Code of Standard Practice for Steel Buildings and Bridges" for mill material.
 4. Verify that weld sizes, fabrication sequence, and equipment used for architecturally exposed structural steel will limit distortions to allowable tolerances. Prevent weld show-through on exposed steel surfaces.
 - a. Grind butt welds flush.
 - b. Grind or fill exposed fillet welds to smooth profile. Dress exposed welds.

3.5 FIELD QUALITY CONTROL

- A. Testing Agency: Owner will engage a qualified independent testing and inspecting agency to inspect field welds and high-strength bolted connections.
- B. Bolted Connections: Field-bolted connections will be inspected according to RCSC's "Specification for Structural Joints Using ASTM A 325 or A 490 Bolts."
- C. Welded Connections: Field welds will be visually inspected according to AWS D1.1.
1. In addition to visual inspection, all full penetration field welds will be tested according to AWS D1.1 and the following inspection procedures, at testing agency's option:
 - a. Liquid Penetrant Inspection: ASTM E 165.
 - b. Magnetic Particle Inspection: ASTM E 709; performed on root pass and on finished weld. Cracks or zones of incomplete fusion or penetration will not be accepted.
 - c. Ultrasonic Inspection: ASTM E 164.
 - d. Radiographic Inspection: ASTM E 94.
 - D. In addition to visual inspection, test and inspect field-welded shear connectors according to requirements in AWS D1.1 for stud welding and as follows:
 1. Perform bend tests if visual inspections reveal either a less-than- continuous 360-degree flash or welding repairs to any shear connector.
 2. Conduct tests on additional shear connectors if weld fracture occurs on shear connectors already tested, according to requirements in AWS D1.1.
 - E. Correct deficiencies in Work that test reports and inspections indicate does not comply with the Contract Documents.

3.6 REPAIRS AND PROTECTION

- A. Repair damaged galvanized coatings on galvanized items with galvanized repair paint according to ASTM A 780 and manufacturer's written instructions.

- B. Touchup Painting: After installation, promptly clean, prepare, and prime or reprime field connections, rust spots, and abraded surfaces of prime-painted steel.
 - 1. Clean and prepare surfaces by SSPC-SP 2 hand-tool cleaning or SSPC-SP 3 power-tool cleaning.
 - 2. Apply a compatible primer of same type as shop primer used on adjacent surfaces.

END OF SECTION 051200

SECTION 053100 - STEEL DECKING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.
- B. Submit complete definition of scope to Contractor for review.

1.2 SUMMARY

- A. This Section includes the following:
 - 1. Roof deck.
 - 2. Composite floor deck.
- B. Related Sections include the following:
 - 1. Division 01 Section "Sustainable Design (LEED) Requirements" For additional LEED requirements
 - 2. Division 03 Section "Cast-in-Place Concrete" for concrete fill.
 - 3. Division 05 Section "Structural Steel Framing" for shop- and field-welded shear connectors.
 - 4. Division 05 Section "Metal Fabrications" for framing deck openings with miscellaneous steel shapes.
 - 5. Division 05 Section-"Cold Formed Metal Framing".

1.3 SUBMITTALS

- A. Product Data: For each type of deck, accessory, and product indicated.
- B. Shop Drawings: Show layout and types of deck panels, anchorage details, reinforcing channels, pans, cut deck openings, special jointing, accessories, and attachments to other construction.
- C. Product Certificates: For each type of steel deck, signed by product manufacturer.
- D. Welding certificates.
- E. Field quality-control test and inspection reports will be provided by Owner's Testing and Inspections agency.
- F. Product Test Reports: Based on evaluation of comprehensive tests performed by a qualified testing agency, indicating that each of the following complies with requirements:
 - 1. Power-actuated mechanical fasteners.
- G. Research/Evaluation Reports: For steel roof deck.
- H. Shoring drawings for long span decking signed and sealed by a registered professional engineer in the state of North Carolina.

1.4 QUALITY ASSURANCE

- A. Testing Agency Qualifications: An independent agency qualified according to ASTM E 329 for testing indicated.
- B. Welding: Qualify procedures and personnel according to AWS D1.3, "Structural Welding Code - Sheet Steel."
- C. Fire-Test-Response Characteristics: Where indicated, provide steel deck units identical to those tested for fire resistance per ASTM E 119 by a testing and inspecting agency acceptable to authorities having jurisdiction.
 - 1. Fire-Resistance Ratings: Indicated by design designations of applicable testing and inspecting agency.
 - 2. Steel deck units shall be identified with appropriate markings of applicable testing and inspecting agency.
- D. AISI Specifications: Comply with calculated structural characteristics of steel deck according to AISI's "North American Specification for the Design of Cold-Formed Steel Structural Members."
- E. FMG Listing: Provide steel roof deck evaluated by FMG and listed in its "Approval Guide, Building Materials" for Class 1 fire rating and Class 1-90 windstorm ratings.

1.5 DELIVERY, STORAGE, AND HANDLING

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

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. Steel Deck:
 - a. Epic Metals Corporation.
 - b. Metal Dek Group.
 - c. Marlyn Steel Decks, Inc.
 - d. Nucor Corp.; Vulcraft Division.
 - e. United Steel Deck, Inc.
 - f. Verco Manufacturing Co.
 - g. Wheeling Corrugating Company; Div. of Wheeling-Pittsburgh Steel Corporation.

2.2 ROOF DECK-GALVANIZED

- A. Steel Roof Deck: Fabricate panels, without top-flange stiffening grooves, to comply with "SDI Specifications and Commentary for Steel Roof Deck," in SDI Publication No. 30, and with the following:
 - 1. Galvanized Steel Sheet: ASTM A 653, Structural Steel (SS), Grade 33, G60 zinc coating.

2. Deck Profile: As indicated.
3. Profile Depth: As indicated.
4. Design Uncoated-Steel Thickness: As indicated.
5. Design Uncoated-Steel Thicknesses; Deck Unit/Bottom Plate: As indicated.
6. Span Condition: As indicated.
7. Side Laps: Overlapped.

2.3 COMPOSITE FLOOR DECK

- A. Composite Steel Floor Deck: Fabricate panels, with integrally embossed or raised pattern ribs and interlocking side laps, to comply with "SDI Specifications and Commentary for Composite Steel Floor Deck," in SDI Publication No. 30, with the minimum section properties indicated, and with the following:
1. Galvanized Steel Sheet: ASTM A 653, Structural Steel (SS), Grade 50, G60 zinc coating.
 2. Profile Depth: As indicated.
 3. Design Uncoated-Steel Thickness: As indicated.
 4. Span Condition: Triple span or more.
 5. Side Laps: Overlapped.
 6. Provide vented deck at roof areas and terrace area of Level 5.

2.4 ACCESSORIES

- A. General: Provide manufacturer's standard accessory materials for deck that comply with requirements indicated.
- B. Mechanical Fasteners: Corrosion-resistant, low-velocity, power-actuated or pneumatically driven carbon-steel fasteners; or self-drilling, self-threading screws.
- C. Side-Lap Fasteners: Corrosion-resistant, hexagonal washer head; self-drilling, carbon-steel screws, No. 10 minimum diameter.
- D. Miscellaneous Sheet Metal Deck Accessories: Steel sheet, minimum yield strength of 33,000 psi, not less than 0.0359-inch design uncoated thickness, of same material and finish as deck; of profile indicated or required for application.
- E. Pour Stops and Girder Fillers: Steel sheet, minimum yield strength of 33,000 psi, of same material and finish as deck, and of thickness and profile recommended by SDI Publication No. 30 for overhang and slab depth.
- F. Column Closures, End Closures, Z-Closures, and Cover Plates: Steel sheet, of same material, finish, and thickness as deck, unless otherwise indicated.
- G. Rolled Hanger Tabs: Rolled steel sheet hanger attachment devices for use with floor deck.
- H. Weld Washers: Uncoated steel sheet, shaped to fit deck rib, 0.0598 inch thick, with factory-punched hole of 3/8-inch minimum diameter.
- I. Flat Sump Plate: Single-piece steel sheet, 0.0747 inch thick, of same material and finish as deck. For drains, cut holes in the field.
- J. Galvanizing Repair Paint: ASTM A 780.
- K. Repair Paint: Manufacturer's standard rust-inhibitive primer of same color as primer.

3.1 EXAMINATION

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

3.2 INSTALLATION, GENERAL

- A. Install deck panels and accessories according to applicable specifications and commentary in SDI Publication No. 30, manufacturer's written instructions, and requirements in this Section.
- B. For single span floor deck conditions install temporary shoring under decking before placing concrete. Shores to remain in place until concrete reaches 75% of specified design compressive strength.
- C. Locate deck bundles to prevent overloading of supporting members.
- D. Place deck panels on supporting frame and adjust to final position with ends accurately aligned and bearing on supporting frame before being permanently fastened. Do not stretch or contract side-lap interlocks.
- E. Place deck panels flat and square and fasten to supporting frame without warp or deflection.
- F. Cut and neatly fit deck panels and accessories around openings and other work projecting through or adjacent to deck.
- G. Provide additional reinforcement and closure pieces at openings as required for strength, continuity of deck, and support of other work.
- H. Comply with AWS requirements and procedures for manual shielded metal arc welding, appearance and quality of welds, and methods used for correcting welding work.
- I. Mechanical fasteners may be used in lieu of welding to fasten roof deck if indicated on drawings. Locate mechanical fasteners and install according to deck manufacturer's written instructions. by arc spot (puddle) welds of the surface diameter indicated

3.3 ROOF-DECK INSTALLATION

- A. Fasten roof-deck panels to steel supporting members as indicated in drawings.
- B. Side-Lap and Perimeter Edge Fastening: Fasten side laps and perimeter edges of panels between supports as indicated in drawings.
- C. End Bearing: Install deck ends over supporting frame with a minimum end bearing of 1-1/2 inches, with end joints as follows:
 - 1. End Joints: Lapped 2 inches minimum.
- D. Roof Sump Plates: Install over openings provided in roof deck and mechanically fasten flanges to top of deck. Space mechanical fasteners not more than 12 inches apart with at least one fastener at each corner.

- E. Miscellaneous Roof-Deck Accessories: Install ridge and valley plates, finish strips, end closures, and reinforcing channels according to deck manufacturer's written instructions. Mechanically fasten to substrate to provide a complete deck installation.

- 1. Weld cover plates at changes in direction of roof-deck panels, unless otherwise indicated.

3.4 COMPOSITE FLOOR-DECK INSTALLATION

- A. Fasten composite floor-deck panels to steel supporting members by arc spot (puddle) welds of the surface diameter indicated and as follows:
 - 1. Weld Diameter: 5/8 inch, nominal.
 - 2. Weld Spacing: Weld each edge ribs of panel to each support, typical. Space additional welds an average of 12 inches apart, but not more than 18 inches apart if indicated elsewhere in drawings.
- B. Side-Lap and Perimeter Edge Fastening: Fasten side laps and perimeter edges of panels between supports, at 12 inches maximum, and as follows:
 - 1. Mechanically fasten with 5/8" inch, nominal puddle weld.
- C. End Bearing: Install deck ends over supporting frame with a minimum end bearing of 1-1/2 inches, with end joints as follows:
 - 1. End Joints: Lapped or butted at Contractor's option.
- D. Pour Stops and Girder Fillers: Weld steel sheet pour stops and girder fillers to supporting structure according to SDI recommendations, unless otherwise indicated.
- E. Floor-Deck Closures: Weld steel sheet column closures, cell closures, and Z-closures to deck, according to SDI recommendations, to provide tight-fitting closures at open ends of ribs and sides of deck.
- F. Install piercing hanger tabs at 14 inches apart in both directions, within 9 inches of walls at ends, and not more than 12 inches from walls at sides, unless otherwise indicated.

3.5 FIELD QUALITY CONTROL

- A. Testing Agency: Owner will engage a qualified independent testing and inspecting agency to perform field tests and inspections and prepare test reports.
- B. All field welds will be visually inspected by the Testing Agency.
- C. Testing agency will report inspection results promptly and in writing to Contractor and Architect.
- D. Remove and replace work that does not comply with specified requirements.
- E. Additional inspecting, at Contractor's expense, will be performed to determine compliance of corrected work with specified requirements.

3.6 REPAIRS AND PROTECTION

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

- B. Repair Painting: Wire brush and clean rust spots, welds, and abraded areas of prime-painted deck immediately after installation, and apply repair paint.
 - 1. Apply repair paint, of same color as adjacent shop-primed deck, to bottom surfaces of deck.
- C. Provide final protection and maintain conditions to ensure that steel deck is without damage or deterioration at time of Substantial Completion.

END OF SECTION 053100

SECTION 054000 - COLD-FORMED METAL FRAMING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section Includes:
 - 1. Exterior non-load-bearing wall framing.
- B. Related Requirements:
 - 1. Section 055000 "Metal Fabrications" for masonry shelf angles and connections.

1.3 PREINSTALLATION MEETINGS

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

1.4 ACTION SUBMITTALS

- A. Product Data: For each type of cold-formed steel framing product and accessory.
- B. Shop Drawings:
 - 1. Include layout, spacings, sizes, thicknesses, and types of cold-formed steel framing; fabrication; and fastening and anchorage details, including mechanical fasteners.
 - 2. Indicate reinforcing channels, opening framing, supplemental framing, strapping, bracing, bridging, splices, accessories, connection details, and attachment to adjoining work.
 - 3. Signed and sealed drawings by a licensed professional engineer in the state of North Carolina.
- C. Delegated-Design Submittal: For cold-formed steel framing.
 - 1. Signed and sealed calculations by a licensed professional engineer in the state of North Carolina.

1.5 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For testing agency.
- B. Welding certificates.
- C. Product Test Reports: For each listed product, for tests performed by manufacturer and witnessed by a qualified testing agency:
 - 1. Steel sheet.
 - 2. Expansion anchors.

3. Power-actuated anchors.
4. Mechanical fasteners.
5. Vertical deflection clips.
6. Horizontal drift deflection clips
7. Miscellaneous structural clips and accessories.

- D. Research Reports: For non-standard cold-formed steel framing, from ICC-ES.

1.6 QUALITY ASSURANCE

- A. Testing Agency Qualifications: Qualified according to ASTM E 329 for testing indicated.
- B. Product Tests: Mill certificates or data from a qualified independent testing agency, or in-house testing with calibrated test equipment indicating steel sheet complies with requirements, including base-metal thickness, yield strength, tensile strength, total elongation, chemical requirements, and metallic-coating thickness.
- C. Welding Qualifications: Qualify procedures and personnel according to the following:
1. AWS D1.1/D1.1M, "Structural Welding Code - Steel."
 2. AWS D1.3/D1.3M, "Structural Welding Code - Sheet Steel."
- D. Comply with AISI S230 "Standard for Cold-Formed Steel Framing - Prescriptive Method for One and Two Family Dwellings."

1.7 DELIVERY, STORAGE, AND HANDLING

- A. Protect cold-formed steel framing from corrosion, moisture staining, deformation, and other damage during delivery, storage, and handling.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Delegated Design: Engage a qualified professional engineer, as defined in Section 014000 "Quality Requirements," to design cold-formed steel framing.
- B. Structural Performance: Provide cold-formed steel framing capable of withstanding design loads within limits and under conditions indicated.
1. Design Loads: As indicated on drawings.
 2. Deflection Limits: Design framing systems to withstand[**design loads**] without deflections greater than the following:
 - a. Exterior Non-Load-Bearing Framing: Horizontal deflection of 1/360 of the wall height.
 3. Design framing systems to provide for movement of framing members located outside the insulated building envelope without damage or overstressing, sheathing failure, connection failure, undue strain on fasteners and anchors, or other detrimental effects when subject to a maximum ambient temperature change of **120 deg F**.
 4. Design framing system to maintain clearances at openings, to allow for construction tolerances, and to accommodate live load deflection of primary building structure as follows:

- a. Upward and downward movement of 1 inch.
- 5. Design exterior non-load-bearing wall framing to accommodate horizontal deflection without regard for contribution of sheathing materials.
- C. Cold-Formed Steel Framing Design Standards:
 - 1. Floor and Roof Systems: AISI S210.
 - 2. Wall Studs: AISI S211.
 - 3. Headers: AISI S212.
 - 4. Lateral Design: AISI S213.
- D. AISI Specifications and Standards: Unless more stringent requirements are indicated, comply with AISI S100 and AISI S200.
- E. 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 COLD-FORMED STEEL FRAMING, GENERAL

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

2.3 EXTERIOR NON-LOAD-BEARING WALL FRAMING

- A. Steel Studs: Manufacturer's standard C-shaped steel studs, of web depths indicated, punched, with stiffened flanges, and as follows:
 - 1. Minimum Base-Metal Thickness: As required by structural performance.
 - 2. Flange Width: As required by structural performance.
 - 3. Section Properties: As required by structural performance.
- B. Steel Track: Manufacturer's standard U-shaped steel track, of web depths indicated, unpunched, with unstiffened flanges, and as follows:
 - 1. Minimum Base-Metal Thickness: As required by structural performance.
 - 2. Flange Width: As required by structural performance.

- C. Vertical Deflection Clips: Manufacturer's standard bypass or head clips, capable of accommodating upward and downward vertical displacement of primary structure through positive mechanical attachment to stud web.
- D. Single Deflection Track: Manufacturer's single, deep-leg, U-shaped steel track; unpunched, with unstiffened flanges, of web depth to contain studs while allowing free vertical movement, with flanges designed to support horizontal loads and transfer them to the primary structure, and as follows:
 - 1. Minimum Base-Metal Thickness: As required by structural performance.
 - 2. Flange Width: As required by structural performance.
- E. Drift Clips: Manufacturer's standard bypass or head clips, capable of isolating wall stud from upward and downward vertical displacement and lateral drift of primary structure through positive mechanical attachment to stud web and structure.

2.4 FRAMING ACCESSORIES

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

2.5 ANCHORS, CLIPS, AND FASTENERS

- A. Steel Shapes and Clips: ASTM A 36/A 36M, zinc coated by hot-dip process according to ASTM A 123/A 123M.
- B. Anchor Bolts: ASTM F 1554, Grade 55, threaded carbon-steel and carbon-steel nuts; and flat, hardened-steel washers; zinc coated by hot-dip process according to ASTM A 153.
- C. Expansion Anchors: Fabricated from corrosion-resistant materials, with allowable load or strength design capacities calculated according to ICC-ES AC193 and ACI 318 greater than or equal to the design load, as determined by testing per ASTM E 488 conducted by a qualified testing agency.
- D. Power-Actuated Anchors: Fastener system of type suitable for application indicated, fabricated from corrosion-resistant materials, with allowable load capacities calculated according to ICC-ES AC70, greater than or equal to the design load, as determined by testing per ASTM E 1190 conducted by a qualified testing agency.

- E. Mechanical Fasteners: ASTM C 1513, corrosion-resistant-coated, self-drilling, self-tapping, steel drill screws.
 - 1. Head Type: Low-profile head beneath sheathing, manufacturer's standard elsewhere.
- F. Welding Electrodes: Comply with AWS standards.

2.6 MISCELLANEOUS MATERIALS

- A. Galvanizing Repair Paint: SSPC-Paint 20 or MIL-P-21035B.
- B. Cement Grout: Portland cement, ASTM C 150, Type I; and clean, natural sand, ASTM C 404. Mix at ratio of 1 part cement to 2-1/2 parts sand, by volume, with minimum water required for placement and hydration.
- C. Nonmetallic, Nonshrink Grout: Premixed, nonmetallic, noncorrosive, nonstaining grout containing selected silica sands, portland cement, shrinkage-compensating agents, and plasticizing and water-reducing agents, complying with ASTM C 1107, with fluid consistency and 30-minute working time.
- D. Shims: Load bearing, high-density multimonomer plastic, and nonleaching; or of cold-formed steel of same grade and coating as framing members supported by shims.
- E. Sealer Gaskets: Closed-cell neoprene foam, 1/4 inch thick, selected from manufacturer's standard widths to match width of bottom track or rim track members.

2.7 FABRICATION

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

1. Spacing: Space individual framing members no more than plus or minus 1/8 inch (3 mm) from plan location. Cumulative error shall not exceed minimum fastening requirements of sheathing or other finishing materials.
2. Squareness: Fabricate each cold-formed steel framing assembly to a maximum out-of-square tolerance of 1/8 inch.

PART 3 - EXECUTION

3.1 EXAMINATION

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

3.2 PREPARATION

- A. Before sprayed fire-resistive materials are applied, attach continuous angles, supplementary framing, or tracks to structural members indicated to receive sprayed fire-resistive materials.
- B. After applying sprayed fire-resistive materials, remove only as much of these materials as needed to complete installation of cold-formed framing without reducing thickness of fire-resistive materials below that are required to obtain fire-resistance rating indicated. Protect remaining fire-resistive materials from damage.
- C. Install load bearing shims or grout between the underside of load-bearing wall bottom track and the top of foundation wall or slab at locations with a gap larger than 1/4 inch (6 mm) to ensure a uniform bearing surface on supporting concrete or masonry construction.
- D. Install sealer gaskets at the underside of wall bottom track or rim track and at the top of foundation wall or slab at stud or joist locations.

3.3 INSTALLATION, GENERAL

- A. Cold-formed steel framing may be shop or field fabricated for installation, or it may be field assembled.
- B. Install cold-formed steel framing according to AISI S200 and to manufacturer's written instructions unless more stringent requirements are indicated.
- C. Install shop- or field-fabricated, cold-formed framing and securely anchor to supporting structure.
 1. Screw, bolt, or weld wall panels at horizontal and vertical junctures to produce flush, even, true-to-line joints with maximum variation in plane and true position between fabricated panels not exceeding 1/16 inch (1.6 mm).
- D. Install cold-formed steel framing and accessories plumb, square, and true to line, and with connections securely fastened.
 1. Cut framing members by sawing or shearing; do not torch cut.
 2. Fasten cold-formed steel framing members by welding, screw fastening, clinch fastening, or riveting. Wire tying of framing members is not permitted.

- a. Comply with AWS D1.3 requirements and procedures for welding, appearance and quality of welds, and methods used in correcting welding work.
 - b. Locate mechanical fasteners and install according to Shop Drawings, and complying with requirements for spacing, edge distances, and screw penetration.
- E. Install framing members in one-piece lengths unless splice connections are indicated for track or tension members.
- F. Install temporary bracing and supports to secure framing and support loads comparable in intensity to those for which structure was designed. Maintain braces and supports in place, undisturbed, until entire integrated supporting structure has been completed and permanent connections to framing are secured.
- G. Do not bridge building expansion joints with cold-formed steel framing. Independently frame both sides of joints.
- H. Install insulation, specified in Section 072100 "Thermal Insulation," in built-up exterior framing members, such as headers, sills, boxed joists, and multiple studs at openings, that are inaccessible on completion of framing work.
- I. Fasten hole reinforcing plate over web penetrations that exceed size of manufacturer's approved or standard punched openings.
- J. Erection Tolerances: Install cold-formed steel framing level, plumb, and true to line to a maximum allowable tolerance variation of 1/8 inch in 10 feet and as follows:
- 1. Space individual framing members no more than plus or minus 1/8 inch from plan location. Cumulative error shall not exceed minimum fastening requirements of sheathing or other finishing materials.

3.4 EXTERIOR NON-LOAD-BEARING WALL INSTALLATION

- A. Install continuous tracks sized to match studs. Align tracks accurately and securely anchor to supporting structure as indicated.
- B. Fasten both flanges of studs to top and bottom track unless otherwise indicated. Space studs as follows:
- 1. Stud Spacing: as required by structural performance, 16" o/c maximum.
- C. Set studs plumb, except as needed for diagonal bracing or required for nonplumb walls or warped surfaces and similar requirements.
- D. Isolate non-load-bearing steel framing from building structure to prevent transfer of vertical loads while providing lateral support.
- 1. Install single deep-leg deflection tracks and anchor to building structure.
 - 2. Install double deep-leg deflection tracks and anchor outer track to building structure.
 - 3. Connect vertical deflection clips to bypassing or infill studs and anchor to building structure.
 - 4. Connect drift clips to cold-formed metal framing and anchor to building structure.
- E. Install horizontal bridging in wall studs, spaced vertically in rows indicated on Shop Drawings but not more than 48 inches apart. Fasten at each stud intersection.

1. Top Bridging for Single Deflection Track: Install row of horizontal bridging within 12 inches of single deflection track. Install a combination of bridging and stud or stud-track solid blocking of width and thickness matching studs, secured to stud webs or flanges.
 - a. Install solid blocking as required by Structural Performance (48" o/c maximum).
 2. Bridging: Cold-rolled steel channel, welded or mechanically fastened to webs of punched studs.
 3. Bridging: Combination of flat, taut, steel sheet straps of width and thickness indicated and stud-track solid blocking of width and thickness to match studs. Fasten flat straps to stud flanges and secure solid blocking to stud webs or flanges.
 4. Bridging: Proprietary bridging bars installed according to manufacturer's written instructions.
- F. Install miscellaneous framing and connections, including stud kickers, web stiffeners, clip angles, continuous angles, anchors, and fasteners, to provide a complete and stable wall-framing system.

3.5 FIELD QUALITY CONTROL

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

3.6 REPAIRS AND PROTECTION

- A. Galvanizing Repairs: Prepare and repair damaged galvanized coatings on fabricated and installed cold-formed steel framing with galvanized repair paint according to ASTM A 780 and manufacturer's written instructions.
- B. Provide final protection and maintain conditions, in a manner acceptable to manufacturer and Installer, that ensure that cold-formed steel framing is without damage or deterioration at time of Substantial Completion.

END OF SECTION 054000

SECTION 055000 - METAL FABRICATIONS

PART 1 - GENERAL

1.1 SUMMARY

- A. Work of this Section includes, but is not limited to, the following:
 - 1. Aluminum plate copings.
 - 2. Miscellaneous steel trim.
 - 3. Loose steel lintels.
 - 4. Countertop supports.
 - 5. Aluminum plate canopy at restroom entrance.
 - 6. All other metal fabrications not included under other sections of the Specifications.
- B. Products furnished, but not installed, under this Section include the following:
 - 1. Anchor bolts and inserts indicated to be cast into concrete or built into unit masonry.
 - 2. Steel weld plates and angles for casting into concrete for applications where they are not specified in other Sections.
- C. Related Documents and Sections: Examine Contract Documents for requirements that directly affect or are affected by Work of this Section. Other Documents and Sections that directly relate to work of this Section include, but are not limited to:
 - 1. General provisions of the Contract, including General and Supplementary Conditions, and Division 01 General Requirements Specification Sections.
 - 2. Section 033000 - CAST-IN-PLACE CONCRETE.
 - 3. Section 042000 - UNIT MASONRY.
 - 4. Section 051200 - STRUCTURAL STEEL.
 - 5. Section 099600 - HIGH PERFORMANCE COATINGS.

1.2 SUBMITTALS

- A. Action Submittals:
 - 1. Product Data: For the following:
 - a. Paint products.
 - b. Grout.
 - 2. Shop Drawings: Detail fabrication and erection of each metal fabrication indicated. Include plans, elevations, sections, and details of metal fabrications and their connections. Show anchorage and accessory items.
 - a. Provide templates for anchors and bolts specified for installation under other Sections.

3. Samples for Verification: For each type and finish of extruded tread.

B. Informational Submittals:

1. Welding Certificates: Copies of certificates for welding procedures and personnel.
2. Qualification Data: For firms and persons specified in "Quality Assurance" Article to demonstrate their capabilities and experience. Include lists of completed projects with project names and addresses, names and addresses of architects and owners, and other information specified.
3. Quality Assurance Submittals:
 - a. Mill Certificates: Signed by manufacturers of stainless-steel sheet certifying that products furnished comply with requirements.
 - b. Welding certificates.

1.3 QUALITY ASSURANCE

- A. Fabricator Qualifications: A firm experienced in producing metal fabrications similar to those indicated for this Project and with a record of successful in-service performance, as well as sufficient production capacity to produce required units.
- B. Welding: Qualify procedures and personnel according to the following:
 1. AWS D1.1, "Structural Welding Code--Steel."
 2. Certify that each welder has satisfactorily passed AWS qualification tests for welding processes involved and, if pertinent, has undergone recertification.
- C. Shop fabricate work to greatest extent possible. Label each piece in shop to facilitate field assembly.
- D. Mock Ups:
 1. Prior to installing any ornamental metal component or assemblies, construct mockups for each form of construction and finish required to verify selections made under Sample submittals and to demonstrate aesthetic effects as well as qualities of materials and execution.
 2. Building mock ups to comply with the following requirements, using materials indicated for the Work.
 - a. Provide 24" long, fully finished typical two-panel connection at joint, base connection, edges and corner. Architect will identify scope and location if not otherwise noted on the drawings.
 - b. Notify Architect 7 days in advance of the dates and times when mockups will be constructed.
 - c. Demonstrate the proposed range of aesthetic effects and workmanship, including full panel assembly and attachment, installation of construction adhesive at fasteners.
 - d. Any welding exposed to view to be mocked-up for approval and if accepted, may become part of the project.
 - e. Obtain approval of mockups before start of Work.

1.4 PROJECT CONDITIONS

- A. Field Measurements: Where metal fabrications are indicated to fit walls and other construction, verify dimensions by field measurements before fabrication and indicate measurements on Shop Drawings. Coordinate fabrication schedule with construction progress to avoid delaying the Work.
 - 1. Established Dimensions: Where field measurements cannot be made without delaying the Work, establish dimensions and proceed with fabricating metal fabrications without field measurements. Coordinate construction to ensure that actual dimensions correspond to established dimensions. Allow for trimming and fitting.

1.5 COORDINATION

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

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Store work off of the ground and under cover. Protect from damage. Maintain shop applied primer coatings. Sequence deliveries to avoid delays, but minimize on-site storage.
 - 1. Mark products with Shop Drawing location reference, unless already properly marked.
 - 2. Use removable tags or concealed markings.

PART 2 - PRODUCTS

2.1 METALS, GENERAL

- A. Metal Surfaces, General: For metal fabrications 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.

2.2 MATERIALS - METALS

- A. Steel Shapes, Plates and Bars: ASTM A36.
- B. Steel Tubing: ASTM A500 or A501, Grade B, hot or cold rolled.
- C. Steel Sheet: ASTM A366, A570 or A611, of grade required for design loading.
- D. Rolled-Steel Floor Plate: ASTM A786, rolled from plate complying with ASTM A36 or ASTM A283, Grade C or D.

- E. Steel Pipe: ASTM A53, black schedule 40, unless indicated otherwise. Type and grade as required for design loading.
- F. Steel Threaded Rod: ASTM A449, 120 ksi minimum, size and grade as required design loading.
- G. Slotted Channel Framing: Cold-formed metal channels with flange edges returned toward web and with 9/16 inch wide slotted holes in webs at 2 inches o.c.
- H. Steel Plates, Shapes, and Bars: ASTM A36.
- I. Stainless-Steel Sheet, Strip, Plate, and Flat Bars: ASTM A666, Type 304.
- J. Stainless-Steel Bars and Shapes: ASTM A276, Type 304.
- K. Aluminum Plate and Sheet: ASTM B209, Alloy 6061-T6.
- L. Aluminum Extrusions: ASTM B221, Alloy 6063-T6.
- M. Aluminum-Alloy Rolled Tread Plate: ASTM B632, Alloy 6061-T6.
- N. Aluminum Castings: ASTM B26, Alloy 443.0-F.

2.3 FASTENERS

- A. General: Provide Zinc-plated fasteners with coating complying with ASTM B633, Class Fe/Zn 5, where built into exterior walls and masonry. Select fasteners for type, grade, and class required.
- B. Bolts and Nuts: Regular hexagon-head bolts, ASTM A307, Grade A; with hex nuts, ASTM A563; and, where indicated, flat washers.
- C. Anchor Bolts: ASTM F1554, Grade 36.
- D. Machine Screws: ASME B18.6.3.
- E. Lag Bolts: ASME B18.2.1.
- F. Wood Screws: Flat head, carbon steel, ASME B18.6.1.
- G. Plain Washers: Round, carbon steel, ASME B18.22.1.
- H. Lock Washers: Helical, spring type, carbon steel, ASME B18.21.1.
- I. Cast-in-Place Anchors in Concrete: Anchors capable of sustaining, without failure, a load equal to four (4) times the load imposed, as determined by testing according to ASTM E488, conducted by a qualified independent testing agency.
 - 1. Threaded or wedge type; galvanized ferrous castings, either ASTM A47 malleable iron or ASTM A27 cast steel.
 - 2. Provide bolts, washers, and shims as needed, hot-dip galvanized per ASTM A153.
- J. Expansion Anchors: Anchor bolt and sleeve assembly with capability to sustain, without

failure, a load equal to six (6) times the load imposed when installed in unit masonry and four times the load imposed when installed in concrete, as determined by testing according to ASTM E488, conducted by a qualified independent testing agency.

1. Material for Anchors in Interior Locations: Carbon-steel components zinc-plated to comply with ASTM B633, Class Fe/Zn 5.

2.4 MISCELLANEOUS MATERIALS

- A. Welding Rods and Bare Electrodes: Select according to AWS specifications for metal alloy welded.
- B. Non-shrink, Non-metallic Grout: Factory-packaged, non-staining, non-corrosive, non-gaseous grout complying with ASTM C1107.

2.5 FABRICATION

- A. Fabricate work of this Section to be straight, plumb, level and square, and to sizes, shapes and profiles indicated on approved shop drawings. Ease exposed edges. Cut, reinforce, drill and tap metal work as required for proper assembly.
 1. Fabricate miscellaneous supports, brackets, braces and the like required to fully complete the work.
 2. Obtain loading requirements from suppliers of work to be supported. Design and support systems with a safety factor of at least 6 unless otherwise indicated.
 3. Shear and punch metals accurately. Remove burrs.
 4. Ease exposed edges to a radius of approximately 1/32 inch, unless indicated otherwise. Form bent corners to smallest radius possible without causing grain separation or impairing work.
 5. Remove sharp or rough areas on exposed traffic surfaces.
 6. Weld seams continuously. Spot welding is permitted for temporary welding only.
- B. Work Exposed to View: For work exposed to view, select materials with special care. Provide materials which are smooth and free of blemishes such as pits, roller marks, trade names, scale and roughness. Fabricate work with uniform hairline joints. Form welded joints and seams continuously. Grind welds flush to be smooth after painting. For exposed fasteners, use hex head bolts or Phillips head machine screws.
- C. Aluminum Plate Copings and Restroom Canopy: 1/8 in thick aluminum. Refer to the Drawings.
 1. Form bent-metal corners to smallest radius possible without causing grain separation or otherwise impairing the Work.
 2. Cut, drill, and punch metals cleanly and accurately. Remove burrs and ease edges to a radius of approximately 1/8 inch unless otherwise indicated. Remove sharp or rough areas on exposed surfaces.
 3. Mill joints to a tight, hairline fit. Cope or miter corner joints. Fabricate connections that will be exposed to weather in a manner to exclude water.
 4. Provide weep holes where water may accumulate. Locate weep holes in

inconspicuous locations.

5. Provide necessary rebates, lugs, and brackets to assemble units and to attach to other work. Cut, reinforce, drill, and tap as needed to receive finish hardware, screws, and similar items unless otherwise indicated.
6. Remove blemishes by filling or grinding or by welding and grinding, before cleaning, treating, and shop priming.
7. Fabricate with piece marks fully hidden in the completed structure or made with media that permits full removal after erection.

D. Miscellaneous Framing and Supports

1. General: Provide steel framing and supports not specified in other Sections as needed to complete the Work.
2. Fabricate units from steel shapes, plates, and bars of welded construction, unless otherwise indicated.
 - a. Fabricate to sizes, shapes, and profiles indicated and as necessary to receive adjacent construction retained by framing and supports.
 - b. Cut, drill, and tap units to receive hardware, hangers, and similar items.
 - c. Fabricate units from slotted channel framing where indicated.
 - d. Furnish inserts if units are installed after concrete is placed.
3. Fabricate supports for operable partitions from continuous steel beams of sizes indicated with attached bearing plates, anchors, and braces as indicated.
 - a. Drill bottom flanges of beams to receive partition track hanger rods; locate holes where indicated on operable partition Shop Drawings.
4. Galvanize miscellaneous framing and supports where indicated.
5. Prime miscellaneous framing and supports with zinc-rich primer where indicated.

E. Loose Steel Lintels: 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.

1. 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.
2. Galvanize loose steel lintels located in exterior walls.
3. Prime loose steel lintels located in exterior walls with primer specified in Section 099600 - High-Performance Coatings

F. Loose Bearing and Leveling Plates

1. Provide loose bearing and leveling plates for steel items bearing on masonry or concrete construction.
 - a. Drill plates to receive anchor bolts and for grouting.
2. Galvanize plates after fabrication.
3. Prime plates with zinc-rich primer.

G. Steel Weld Plates and Angles

1. Provide steel weld plates and angles not specified in other Sections, for items supported from concrete construction as needed to complete the Work.
 - a. Provide each unit with not less than two integrally welded steel strap anchors for embedding in concrete.

H. Miscellaneous Steel Trim:

1. Unless otherwise indicated, fabricate units from steel shapes, plates, and bars of profiles shown with continuously welded joints and smooth exposed edges. Miter corners and use concealed field splices where possible.
2. Provide cutouts, fittings, and anchorages as needed to coordinate assembly and installation with other work.
 - a. Provide with integrally welded steel strap anchors for embedding in concrete or masonry construction.
3. Galvanize exterior miscellaneous steel trim.

2.6 FINISHES, GENERAL

- A. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.
- B. Finish metal fabrications after assembly.

2.7 SHOP FINISHING

- A. General: Prepare surfaces and apply finishes to match accepted samples and mockups and according to finish manufacturer's written recommendations.
- B. As Fabricated: Remove loose rust, slag, flux deposits, oil, and grease.
- C. Surface Preparation: SSPC SP-1, "Solvent Cleaning".
- D. Do not remove mill and fabricator markings (to be confirmed with client).
- E. Universal Shop Primer: Fast-curing, lead- and chromate-free, universal modified-alkyd primer complying with MPI#79 and compatible with topcoat.
 1. Use primer containing pigments that make it easily distinguishable from zinc-rich primer.
- F. Epoxy Zinc-Rich Primer: Complying with MPI#20 and compatible with topcoat.
- G. Galvanizing: Hot-dip galvanize all exterior miscellaneous metalwork, all items located in exterior wall and roof assemblies, and all items indicated to be galvanized in strict compliance with ASTM A123, A143, A153, A384, A385, and A386. Any item that is cut, welded, or is otherwise damaged must be repainted with an acceptable zinc-rich coating product.
 1. Nickel Zinc: Comply with ASTM B6.
 2. Coverage: Provide at least 2.0 oz./sq.ft. nickel zinc coverage, but not less than the

- coverage required by referenced standards.
- 3. Fabrication: To the greatest extent possible, galvanize after fabrication is completed.
- 4. Touch Up: Touch-up damaged or abraded galvanized surfaces with cold galvanizing compound complying with ASTM A780.
- H. Bituminous Paint: Cold-applied asphalt mastic complying with SSPC-Paint 12, except containing no asbestos fibers, or cold-applied asphalt emulsion complying with SSPC-Paint 20 and compatible with topcoat.
 - 1. Interior Products: Subject to compliance with requirements, with ASTM D1187.
- I. Aluminum Finish:
 - 1. Fluoropolymer Coating: Provide high performance coating system consisting of primer and color finish coat conforming to AAMA 2604. Properly prepare substrates by inhibited chemical cleaning, conversion coating, and priming in compliance with coating manufacturer's instructions and recommendations. Provide minimum 1.0 mil dry film thickness of thermo-cured fluoropolymer color coating containing minimum 50% of one of the following resins:
 - a. Hylar 5000; Ausimont USA, Inc., Morristown, NJ 07962-1838
 - b. Kynar 500; Atochem North America, Inc., Philadelphia, PA 19102.
 - c. Solef 6008; Solvay USA, Albright, WV 26519
 - 2. Color: As selected by the Architect.

PART 3 - EXECUTION

3.1 INSTALLATION, GENERAL

- A. Fastening to In-Place Construction: Provide anchorage devices and fasteners where necessary for securing metal fabrications to in-place construction. Include threaded fasteners for concrete and masonry inserts, toggle bolts, through-bolts, lag bolts, wood screws, and other connectors.
- B. 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.
- C. Provide temporary bracing or anchors in formwork for items that are to be built into concrete, masonry, or similar construction.
- D. Fit exposed connections accurately together to form hairline joints. Weld connections that are not to be left as exposed joints but cannot be shop welded because of shipping size limitations. Do not weld, cut, or abrade surfaces of exterior units that have been hot-dip galvanized after fabrication and are for bolted or screwed field connections.
- E. Control of Corrosion: Prevent galvanic action and other forms of corrosion by insulating metals and other materials from direct contact with incompatible materials.

1. Coat, with a heavy coat of bituminous paint, concealed surfaces of aluminum that are in contact with grout, concrete, masonry, wood, or dissimilar metals.
- F. 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.
- G. Corrosion Protection: Coat concealed surfaces of aluminum that will come into contact with grout, concrete, masonry, wood, or dissimilar metals with a heavy coat of bituminous paint.

3.2 ADJUSTING AND CLEANING

- A. Touchup Painting: Immediately after erection, clean field welds, bolted connections, and abraded areas of shop paint, and paint exposed areas with the same material as used for shop painting to comply with SSPC-PA 1 for touching up shop-painted surfaces.
- B. Galvanized Surfaces: Clean field welds, bolted connections, and abraded areas and repair galvanizing to comply with ASTM A780.

3.3 CLEANING AND PROTECTION

- A. At end of each workday, remove rubbish other discarded materials from Project site.
- B. Protect the work of other trades and work of this Section already installed against soiling and damage by the exercise of reasonable care and precautions. Repair or replace any work so damaged or soiled.
- C. At completion of construction activities of other trades, touch up and restore damaged or defaced coated surfaces.

3.4 WASTE MANAGEMENT

- A. Separate and dispose of waste in accordance with the Project's Waste Management Plan.

END OF SECTION

SECTION 055113 - METAL PAN STAIRS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Preassembled steel stairs with concrete-filled treads.
2. Steel tube railings attached to metal stairs.
3. Steel tube handrails attached to walls adjacent to metal stairs.

B. Related Documents and Sections: Examine Contract Documents for requirements that directly affect or are affected by Work of this Section. Other Documents and Sections that directly relate to work of this Section include, but are not limited to:

1. General provisions of the Contract, including General and Supplementary Conditions, and Division 01 General Requirements Specification Sections.
2. Section 033000 - CAST-IN-PLACE CONCRETE.
3. Section 055000 - METAL FABRICATIONS.
4. Section 055200 - HANDRAILS AND RAILINGS

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 anchorages for metal stairs. Furnish setting drawings, templates, and directions for installing anchorages, including sleeves, concrete inserts, anchor bolts, and items with integral anchors, that are to be embedded in concrete or masonry. Deliver such items to Project site in time for installation.
- C.** Coordinate locations of hanger rods and struts with other work so that they do not encroach on required stair width and are within the fire-resistance-rated stair enclosure.

1.3 SUBMITTALS

A. Product Data: For metal pan stairs and the following:

1. Metal-pan-stair treads.
2. Nonslip aggregates and nonslip-aggregate finishes.
3. Abrasive nosings.
4. Paint products.

B. Shop Drawings: Include plans, elevations, sections, details, and attachments to other

work.

- C. Delegated-Design Submittal: For stairs and railings, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation. Engineer shall be registered in the state that the project is located. Shop Drawings shall be stamped and signed by an Engineer registered in the State that the project is located.
 - 1. Provide vibration and sway analysis with calculations. The maximum horizontal deflection is 1/4 in. The vibration shall be designed to AISC Design Guide 34, Steel-framed stairway design.
- D. Informational Submittals:
 - 1. Welding certificates.
 - 2. Paint Compatibility Certificates: From manufacturers of topcoats applied over shop primers certifying that shop primers are compatible with topcoats.

1.4 QUALITY ASSURANCE

- A. Delegated Design: Engage a qualified professional engineer, as defined in Section 014000 - QUALITY REQUIREMENTS, to design stairs and railings.
- B. Installer Qualifications: Fabricator of products.
- C. Welding Qualifications: Qualify procedures and personnel according to the following:
 - 1. AWS D1.1/D1.1M, "Structural Welding Code - Steel."
 - 2. AWS D1.3/D1.3M, "Structural Welding Code - Sheet Steel."

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Structural Performance of Stairs: Metal stairs shall withstand the effects of gravity loads and the loads and stresses within limits and under conditions indicated below and on the structural drawings:
 - 1. Uniform Load: 100 lbf/sq. ft. (4.79 kN/sq. m).
 - 2. Concentrated Load: 300 lbf (1.33 kN) applied on an area of 4 sq. in. (2580 sq. mm).
 - 3. Uniform and concentrated loads need not be assumed to act concurrently.
 - 4. Stair Framing: Capable of withstanding stresses resulting from railing loads in addition to loads specified above.
 - 5. Limit deflection of treads, platforms, and framing members to L/360 or 1/4 inch (6.4 mm), whichever is less.
- B. Structural Performance of Railings: Railings shall withstand the effects of gravity loads and the following loads and stresses within limits and under conditions indicated:
 - 1. Limit deflection of railings to L/360 or 1/4 in., whichever is less.

2. Handrails and Top Rails of Guards:
 - a. Uniform load of 50 lbf/ft. (0.73 kN/m) applied in any direction.
 - b. Concentrated load of 200 lbf (0.89 kN) applied in any direction.
 - c. Uniform and concentrated loads need not be assumed to act concurrently.
3. Infill of Guards:
 - a. Concentrated load of 50 lbf (0.22 kN) applied horizontally on an area of 1 sq. ft. (0.093 sq. m).
 - b. Infill load and other loads need not be assumed to act concurrently.
- C. Seismic Performance of Stairs: Metal stairs shall withstand the effects of earthquake motions determined according to ASCE/SEI 7.
 1. Component Importance Factor: 1.5.

2.2 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, the following:
 1. Alfab, Inc.
 2. American Stair, Inc.
 3. Lapeyre Stair Inc.
 4. Perma-Pipe, Inc.

2.3 METALS

- A. Metal Surfaces, General: Provide materials with smooth, flat surfaces unless otherwise indicated. For components exposed to view in the completed Work, provide materials without seam marks, roller marks, rolled trade names, or blemishes.
- B. Steel Plates, Shapes, and Bars: ASTM A 36/A 36M.
- C. Steel Tubing: ASTM A 500 (cold formed).
- D. Cast Iron: Either gray iron, ASTM A 48/A 48M, or malleable iron, ASTM A 47/A 47M, unless otherwise indicated.
- E. Uncoated, Cold-Rolled Steel Sheet: ASTM A 1008/A 1008M, structural steel, Grade 25 (Grade 170), unless another grade is required by design loads; exposed.
- F. Galvanized-Steel Sheet: ASTM A 653/A 653M, G90 (Z275) coating, structural steel, Grade 33 (Grade 230), unless another grade is required by design loads.

2.4 ABRASIVE NOSINGS

- A. Extruded Units: Aluminum or bronze units with abrasive filler consisting of aluminum oxide, silicon carbide, or a combination of both, in an epoxy-resin binder. Fabricate units in lengths necessary to accurately fit openings or conditions.

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, the following:
 - a. ACL Industries, Inc.
 - b. American Safety Tread Co., Inc.
 - c. Amstep Products.
 - d. Balco, Inc.
 - e. Granite State Casting Co.
 - f. Nystrom, Inc.
 2. Provide ribbed units, with abrasive filler strips projecting 1/16 inch (1.5 mm) above aluminum extrusion.
 3. Nosings: Two-piece units, 3 inches (75 mm) wide, with subchannel for casting into concrete.
- B. Provide anchors for embedding units in concrete, either integral or applied to units, as standard with manufacturer.
- C. Apply bituminous paint to concealed surfaces of cast-metal units set into concrete.
- D. Apply clear lacquer to concealed surfaces of extruded units set into concrete.

2.5 FASTENERS

- A. General: Provide zinc-plated fasteners with coating complying with ASTM B 633 or ASTM F 1941 (ASTM F 1941M), Class Fe/Zn 12 for exterior use, and Class Fe/Zn 5 where built into exterior walls. Select fasteners for type, grade, and class required.
- B. Bolts and Nuts: Regular hexagon-head bolts, ASTM A 307, Grade A (ASTM F 568M, Property Class 4.6); with hex nuts, ASTM A 563 (ASTM A 563M); and, where indicated, flat washers.
- C. Anchor Bolts: ASTM F 1554, Grade 36, of dimensions indicated; with nuts, ASTM A 563 (ASTM A 563M); and, where indicated, flat washers.
1. Provide mechanically deposited or hot-dip, zinc-coated anchor bolts for exterior steel components.
- D. Post-Installed Anchors: Chemical anchors capable of sustaining, without failure, a load equal to six times the load imposed when installed in unit masonry and four times the load imposed when installed in concrete, as determined by testing according to ASTM E 488/E 488M, conducted by a qualified independent testing agency.
1. Material for Interior Locations: Carbon-steel components zinc plated to comply with ASTM B 633 or ASTM F 1941 (ASTM F 1941M), Class Fe/Zn 5, unless otherwise indicated.
 2. Material for Exterior Locations and Where Stainless Steel Is Indicated: Alloy Group (1) A1 stainless-steel bolts, ASTM F 593 (ASTM F 738M), and nuts, ASTM F 594 (ASTM F 836M).

2.6 MISCELLANEOUS MATERIALS

- A. Universal Shop Primer: Fast-curing, lead- and chromate-free, universal modified-alkyd primer complying with MPI#79 and compatible with topcoat.
 - 1. Use primer containing pigments that make it easily distinguishable from zinc-rich primer.
- 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. Bituminous Paint: Cold-applied asphalt emulsion complying with ASTM D 1187/D 1187M.
- E. Concrete Materials and Properties: Comply with requirements in Section 033000 - CAST-IN-PLACE CONCRETE for normal-weight, air-entrained, ready-mix concrete with a minimum 28-day compressive strength of 4000 psi (28 MPa) with 3% fiberglass mesh additive...
 - 1. Nonslip-Aggregate Concrete Finish: Factory-packaged abrasive aggregate made from fused, aluminum-oxide grits or crushed emery; rustproof and nonglazing; unaffected by freezing, moisture, or cleaning materials.

2.7 FABRICATION, GENERAL

- A. Provide complete stair assemblies, including metal framing, hangers, struts, railings, clips, brackets, bearing plates, and other components necessary to support and anchor stairs and platforms on supporting structure.
 - 1. Join components by welding unless otherwise indicated.
 - 2. Use connections that maintain structural value of joined pieces.
- B. Preassembled Stairs: Assemble stairs in shop to greatest extent possible. Disassemble units only as necessary for shipping and handling limitations. Clearly mark units for reassembly and coordinated installation.
- C. Cut, drill, and punch metals cleanly and accurately. Remove burrs and ease edges to a radius of approximately 1/32 inch (1 mm) unless otherwise indicated. Remove sharp or rough areas on exposed surfaces.
- D. Form bent-metal corners to smallest radius possible without causing grain separation or otherwise impairing work.
- E. Form exposed work with accurate angles and surfaces and straight edges.
- F. Weld connections to comply with the following:
 - 1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
 - 2. Obtain fusion without undercut or overlap.

3. Remove welding flux immediately.
 4. Weld exposed corners and seams continuously unless otherwise indicated.
 5. At exposed connections, Finish welds to comply with NOMMA's "Voluntary Joint Finish Standards" for Type 2 welds: completely sanded joint, some undercutting and pinholes are okay as shown in NAAMM AMP 521.
- G. Form exposed connections with hairline joints, flush and smooth, using concealed fasteners where possible. Where exposed fasteners are required, use Phillips flat-head (countersunk) screws or bolts unless otherwise indicated. Locate joints where least conspicuous.

2.8 STEEL-FRAMED STAIRS

- A. NAAMM Stair Standard: Comply with "Recommended Voluntary Minimum Standards for Fixed Metal Stairs" in NAAMM AMP 510, "Metal Stairs Manual," Commercial Class, unless more stringent requirements are indicated.
- B. Stair Framing:
1. Fabricate stringers of steel channels.
 - a. Provide closures for exposed ends of channel stringers.
 2. Construct platforms of steel channel headers and miscellaneous framing members as indicated.
 3. Weld or bolt stringers to headers; weld framing members to stringers and headers.
 4. Where stairs are enclosed by gypsum board shaft-wall assemblies, provide hanger rods or struts to support landings from floor construction above or below. Locate hanger rods and struts where they do not encroach on required stair width and are within the fire-resistance-rated stair enclosure.
 5. Where masonry walls support metal stairs, provide temporary supporting struts designed for erecting steel stair components before installing masonry.
- C. Metal Pan Stairs: Form risers, subread pans, and subplatforms to configurations shown from steel sheet of thickness needed to comply with performance requirements, but not less than indicated.
1. Steel Sheet: Uncoated cold-rolled steel sheet.
 2. Directly weld metal pans to stringers; locate welds on top of subreads where they are concealed by concrete fill. Do not weld risers to stringers.
 3. Attach abrasive nosings to risers.
 4. Provide subplatforms of configuration indicated or, if not indicated, the same as subreads. Weld subplatforms to platform framing.
 - a. Smooth Soffit Construction: Construct subplatforms with flat metal under surfaces to produce smooth soffits.

2.9 STAIR RAILINGS

- A. Steel Tube Railings: Fabricate railings to comply with requirements indicated for design, dimensions, details, finish, and member sizes, including wall thickness of tube, post

spacings, and anchorage, but not less than that needed to withstand indicated loads.

1. Rails and Posts: 1-1/2-inch-(38-mm-) diameter top and bottom rails and 1-1/2-inch-(38-mm-) diameter posts.
 2. Picket Infill: 1/4-inch diameter round pickets spaced less than 4.75 inches (120 mm) clear.
- B. Welded Connections: Fabricate railings with welded connections. Cope components at connections to provide close fit, or use fittings designed for this purpose. Weld all around at connections, including at fittings.
1. Finish welds to comply with NOMMA's "Voluntary Joint Finish Standards" for Type 2 welds: completely sanded joint, some undercutting and pinholes are okay as shown in NAAMM AMP 521.
- C. Form changes in direction of railings as follows:
1. As detailed.
 2. By radius bends of radius indicated or by inserting prefabricated elbow fittings of radius indicated.
- D. For changes in direction made by bending, use jigs to produce uniform curvature for each repetitive configuration required. Maintain cross section of member throughout entire bend without buckling, twisting, cracking, or otherwise deforming exposed surfaces of components.
- E. Close exposed ends of railing members with prefabricated end fittings.
- F. Provide wall returns at ends of wall-mounted handrails unless otherwise indicated. Close ends of returns unless clearance between end of rail and wall is 1/4 inch (6 mm) or less.
- G. Connect posts to stair framing by direct welding unless otherwise indicated.
- H. Brackets, Flanges, Fittings, Kickplates and Anchors: Provide wall brackets, end closures, flanges, miscellaneous fittings (including kick plates at guardrails), and anchors for interconnecting components and for attaching to other work. Furnish inserts and other anchorage devices for connecting to concrete or masonry work.
1. For galvanized railings, provide galvanized fittings, brackets, fasteners, sleeves, and other ferrous-metal components.
 2. For nongalvanized railings, provide nongalvanized ferrous-metal fittings, brackets, fasteners, and sleeves, except galvanize anchors embedded in exterior masonry and concrete construction.
 3. Provide type of bracket with predrilled hole for exposed bolt anchorage and that provides 1-1/2-inch (38-mm) clearance from inside face of handrail to finished wall surface.
- I. Fillers: Provide fillers made from steel plate where needed to transfer wall bracket loads through wall finishes to structural supports. Size fillers to suit wall finish thicknesses and to produce adequate bearing area to prevent bracket rotation and overstressing of substrate.

2.10 FINISHES

- A. Finish metal stairs after assembly.
- B. 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.
 - 2. Fill vent and drain holes that are exposed in the finished Work, unless indicated to remain as weep holes, by plugging with zinc solder and filing off smooth.
- C. Preparation for Shop Priming: Prepare uncoated ferrous-metal surfaces to comply with SSPC-SP 3, "Power Tool Cleaning."
- D. Apply shop primer to uncoated surfaces of metal stair components, except those with galvanized finishes and those to be embedded in concrete or masonry unless otherwise indicated. Comply with SSPC-PA 1, "Paint Application Specification No. 1: Shop, Field, and Maintenance Painting of Steel," for shop painting.

PART 3 - EXECUTION

3.1 INSTALLING METAL PAN STAIRS

- A. Fastening to In-Place Construction: Provide anchorage devices and fasteners where necessary for securing metal stairs to in-place construction. Include threaded fasteners for concrete and masonry inserts, through-bolts, lag bolts, and other connectors.
- B. Cutting, Fitting, and Placement: Perform cutting, drilling, and fitting required for installing metal stairs. Set units accurately in location, alignment, and elevation, measured from established lines and levels and free of rack.
- C. Install metal stairs by welding stair framing to steel structure or to weld plates cast into concrete unless otherwise indicated.
- D. Provide temporary bracing or anchors in formwork for items that are to be built into concrete, masonry, or similar construction.
- E. 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.
- F. Field Welding: Comply with requirements for welding in "Fabrication, General" Article.
- G. Place and finish concrete fill for treads and platforms to comply with Section 033000 "Cast-in-Place Concrete."
 - 1. Install abrasive nosings with anchors fully embedded in concrete. Center nosings on tread width.

- H. Install precast concrete treads with adhesive supplied by manufacturer.

3.2 INSTALLING RAILINGS

- A. Adjust railing systems before anchoring to ensure matching alignment at abutting joints. Space posts at spacing indicated or, if not indicated, as required by design loads. Plumb posts in each direction. Secure posts and rail ends to building construction as follows:
 - 1. Anchor posts to steel by welding to steel supporting members.
 - 2. Anchor handrail ends to concrete and masonry with steel round flanges welded to rail ends and anchored with post-installed anchors and bolts.
- B. Attach handrails to wall with wall brackets. Locate brackets as indicated or, if not indicated, at spacing required to support structural loads. Secure wall brackets to building construction as required to comply with performance requirements.

3.3 ADJUSTING AND CLEANING

- A. Touchup Painting: Immediately after erection, clean field welds, bolted connections, and abraded areas of shop paint, and paint exposed areas with same material as used for shop painting 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 (0.05-mm) dry film thickness.
- B. Touchup Painting: Cleaning and touchup painting of field welds, bolted connections, and abraded areas of shop paint are specified in Section 099113 "Exterior Painting" and Section 099123 "Interior Painting."
- C. Galvanized Surfaces: Clean field welds, bolted connections, and abraded areas and repair galvanizing to comply with ASTM A 780/A 780M.

3.4 FIELD QUALITY CONTROL

- A. Testing Agency: Owner shall engage a qualified testing agency to perform tests and inspections.
- B. Bolted Connections: Inspect and test bolted connections according to RCSC's "Specification for Structural Joints Using High Strength Bolts."
- C. Welded Connections: Visually inspect 100% of field welds according to AWS D1.1/D1.1M. This will include verification of welder's qualifications and welding procedures and materials.
- D. The Contractor shall correct deficiencies in Work that test reports and inspections indicate does not comply with the Contract Documents.
- E. Record Documents: The Testing Agency shall maintain results of specified tests and shall deliver copies to the Architect and Contractor.

END OF SECTION

SECTION 055223 - MANUFACTURED GUARDRAIL

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes: Manufactured, field-assembled, non-penetrating guardrail system.
 - 1. Steel railing and handrail system.
- B. Related Documents and Sections: Examine Contract Documents for requirements that directly affect or are affected by Work of this Section. A list of those Documents and Sections include, but is not limited to the following:
 - 1. Drawings and general provisions of the Contract, including General and Supplementary Conditions, and Division 01 General Requirements Specification Sections, apply to this Section.
 - 2. Section 033000 - CAST-IN-PLACE CONCRETE.
 - 3. Section 055000 - METAL FABRICATIONS.

1.2 SUBMITTALS

- A. Action Submittals
 - 1. Product Data: Manufacturer's product specifications and descriptive literature.
 - 2. Shop Drawings: Including but not limited to profiles, sizes, connections, sizes and types of fasteners and accessories. Show fabrication and installation of handrails and guardrails including but not limited to plans, elevations, sections, details of components, anchor details, and attachment to adjoining work.
- B. Informational Submittals
 - 1. Delegated-Design Submittal: For guardrail system indicated to comply with performance requirements and design criteria, include the following signed and sealed by the qualified professional engineer responsible for their preparation:
 - a. Design data.

1.3 QUALITY ASSURANCE

- A. Delegated Design: Design railings, including comprehensive engineering analysis by a qualified professional engineer, using performance requirements and design criteria indicated.
- B. Mock-Up: Provide a mock-up for evaluation of surface preparation techniques and application workmanship.
 - 1. Install in areas designated by Architect.

2. Do not proceed with remaining work until workmanship and installation are approved by Architect.
- C. Preinstallation Meetings: Conduct meeting at Project site to comply with requirements in Section 013100 - PROJECT MANAGEMENT AND COORDINATION.
 1. Convene minimum prior to commencing work of this Section.
 2. Attendance Required: Architect, Owner, Contractor, manufacturer's representative, installer, and other parties directly affecting or affected by work of this Section.
 3. Review methods and procedures related to work of this Section including, but not limited to, the following:
 - a. Inspect and discuss condition of substrate and other preparatory work performed by other trades.
 - b. Review structural load limitations.
 - c. Review coordination required with other Sections.

1.4 COORDINATION

- A. Coordinate fabrication and delivery schedule of guardrail system with construction progress and sequence to avoid delay of railing installation.
- B. Coordinate post setting drawings, diagrams, templates, instructions, and directions for installation of anchorages, such as sleeves, concrete inserts, anchor bolts, and miscellaneous items having integral anchors that are to be embedded in concrete and masonry construction.
 1. Coordinate delivery of anchorages to project site.
 2. Coordinate that blocking is in place for all mounting fasteners.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Delivery Requirements: Deliver materials in manufacturer's undamaged packaging, complete with installation instructions.
- B. Deliver, store and handle materials and products in strict compliance with manufacturer's instructions and recommendations and industry standards.
- C. Store materials within temperature and humidity limits recommended by the manufacturer. Protect finishes from damage.

1.6 FIELD CONDITIONS

- A. Ambient Conditions:
 1. Comply with manufacturer's written requirements for maintenance of ambient temperatures, humidity, ventilation, and other conditions required to properly execute and protect the Work.

PART 2 - PRODUCTS

2.1 PERFORMANCE | DESIGN CRITERIA

- A. Structural Performance: Railings shall withstand the effects of gravity loads and the following loads and stresses within limits and under conditions indicated:
- B. Railing Structural Requirements:
 - 1. Handrails and Top Rails of Guards:
 - a. Uniform load of 50 lbf/ft. applied in any direction.
 - b. Concentrated load of 200 lbf applied in any direction.
 - c. Uniform and concentrated loads need not be assumed to act concurrently.
 - 2. Infill of Guards:
 - a. Concentrated load of 200 lbf applied horizontally on an area of 1 sq. ft.
 - b. Infill load and other loads need not be assumed to act concurrently.
- C. Control of Corrosion: Prevent galvanic action and other forms of corrosion by insulating metals and other materials from direct contact with incompatible materials.

2.2 MANUFACTURERS

- A. Basis-of-Design Product: Subject to compliance with requirements, provide SafetyRail 2000 by Blue Water Manufacturing or a comparable product by one of the following:
 - 1. Kee Safety, Inc..
 - 2. Garlock Safety Systems.
 - 3. Dakota Safety.

2.3 DESCRIPTION

- A. Guardrail system consisting of standard manufactured, field-assembled with simple tools, non-penetrating guardrail system. System includes, but is not limited to, pipe, fittings, and accessories as indicated on Drawings and as required to provide code compliant installation.
- B. Regulatory Requirements:
 - 1. OSHA: Comply with OSHA Requirements for guardrails, 29 CFR, Sections 1910.23 and 1926.502
- C. Sustainability Characteristics:
 - 1. Sustainability Requirements for Metal Products: As specified in Division 05 Section "Common Sustainability Requirements for Metal."

2.4 RAILING AND HANDRAIL SYSTEM

A. Handrails and Guardrails:

1. Assembly: Individual components for field assembly with recessed set screws requiring no drilling, welding or threading.
2. Steel Pipe: Galvanized steel ASTM A 53 Grade B seamed tube or Schedule 40 pipe.
 - a. Cast Fittings: Galvanized malleable cast iron, ASTM A 47 with ASTM A 153 galvanizing.
3. Nominal Pipe Size: 1-1/4 inches.
4. Fasteners: Type 304 or 305 stainless steel.

2.5 FABRICATION

A. Field Measurements: Where handrails and railings are indicated to fit to other construction, check actual dimensions of other construction by accurate field measurements before fabrication; show recorded measurements on final shop drawings.

1. Where field measurements cannot be made without delaying the railing fabrication and delivery, obtain guaranteed dimensions in writing by the Contractor and proceed with fabrication of products to not delay fabrication, delivery and installation.

B. Fit and shop assemble components in largest practical sizes for delivery to site.

C. Plug upright tops with weather and light resistant material.

D. Assemble components with joints tightly fitted and secured. Accurately form components to suit installation.

2.6 FINISHES

A. Steel Components:

1. Galvanized Finish: As specified in Division 05 Section "Shop-Applied Galvanic Coatings for Metal".

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verification of Conditions:

1. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for conditions affecting performance of work.

3.2 PREPARATION

- A. Prepare substrates using the methods recommended by the manufacturer for achieving the best result for the substrate under the project conditions.
- B. Maintain surfaces clean and free of debris during installation process using blowers or brooms. Do not walk on or set railings on material that may damage substrate.

3.3 INSTALLATION

- A. Install guardrail system in accordance with manufacturer's printed instructions, OSHA standards, and approved submittals.
 - 1. Perform cutting, drilling, and fitting required for installation of handrails. Set handrails accurately in location, alignment, and elevation, measured from established lines and levels.
 - 2. Fit exposed connections accurately together to form tight joints.
 - 3. Tighten set screws for connections with fittings to 29 foot pounds of torque.
- B. Tolerances: Set posts plumb within a tolerance of 1/8 inch.

3.4 ADJUSTING AND CLEANING

- A. Galvanized Surfaces: Clean field welds, bolted connections, and abraded areas and repair galvanizing to comply with ASTM A 780.

3.5 WASTE MANAGEMENT

- A. Separate and dispose of waste in accordance with the Project's Waste Management Plan.

END OF SECTION

SECTION 057300 - DECORATIVE METAL RAILINGS

PART 1 - GENERAL

1.1 SUMMARY

- A. Provide decorative metal railings. Refer to Drawings and list below.
 - 1. Stainless steel plate with stainless steel wire infill.
- B. Related Documents and Sections: Examine Contract Documents for requirements that directly affect or are affected by Work of this Section. Other Documents and Sections that directly relate to work of this Section include, but are not limited to:
 - 1. General provisions of the Contract, including General and Supplementary Conditions, and Division 01 General Requirements Specification Sections.
 - 2. Section 051000 - STRUCTURAL STEEL.
 - 3. Section 055200 - HANDRAILS AND RAILINGS.
- C. Delegated Design: Work of this Section is subject to Delegated Design requirements described in Division 01.
 - 1. Design work of this Section subject to gravity, seismic loads, and design loads, including comprehensive engineering analysis by a qualified professional engineer, using performance requirements and design criteria indicated.

1.2 SYSTEM DESCRIPTION

- A. Contractor's Design:
 - 1. Engage the services of a Professional Engineer registered in the State of North Carolina to prepare complete shop drawings and structural design computations for work of this Section. Drawings and calculations shall bear the engineer's professional seal and signature.
 - a. Note: Manufacturer's shop drawings stamped by the engineer are acceptable instead of those actually prepared by the engineer.
 - 2. The structural design computations shall provide a complete structural analysis of all typical and special conditions of construction. Show how design load requirements and other performance criteria have been satisfied and conform to the governing laws and building codes.
 - 3. The shop drawings shall show all pertinent details for fabrication and erection of each metal fabrication indicated. Include plans, elevations, sections, and details of metal fabrications and their connections. Show anchorage and accessory items.
 - 4. Provide templates for anchors and bolts specified for installation under other Sections.

1.3 PERFORMANCE REQUIREMENTS

- A. Decorative metal railings shall be designed, fabricated, and installed to accommodate expansion and contraction of metal components without causing undue stress, buckling, opening of joints, and distortion. Design for the following minimum temperature ranges.
 - 1. Ambient Temperature Range: 120 degrees F (67 degrees C).
 - 2. Material Surface Temperature Range: 180 degrees F (100 degrees C).
- B. Design supports and hardware to withstand loads encountered without excessive deflection or distortion when cables are tensioned to required amounts required to conform to applicable building codes.
- C. Components shall be free from defects impairing strength, durability and appearance. Exposed surfaces throughout system shall have same inherent texture and color for similar locations.
- D. Design system to prevent galvanic action and other forms of corrosion by insulating metals and other materials from direct contact with incompatible materials.
- E. Exposed fasteners shall be of same materials, color and finish as material to which applied. Exposed surfaces throughout project shall have same inherent texture and color for similar locations.
- F. Control of Corrosion: Prevent galvanic action and other forms of corrosion by insulating metals and other materials from direct contact with incompatible materials.
- G. Railing Requirements:
 - 1. General: When engineering railings to withstand structural loads indicated, determine allowable design working stresses of railing materials based on the following:
 - a. Steel: 72 percent of minimum yield strength.
 - b. Railing Structural Performance: Provide railings capable of withstanding the effects of gravity loads and the live loads and stresses within limits and under conditions indicated.
 - c. Limit deflection of railings to $L/360$ or $1/4$ in., whichever is less.
 - 2. Handrails:
 - a. Uniform load of 50 lbf/ ft. applied in random directions.
 - b. Concentrated load of 200 lbf applied in random directions.
 - c. Uniform and concentrated loads need not be assumed to act concurrently.
 - 3. Top Rails of Guards:
 - a. Uniform load of 50 lbf/ ft. applied horizontally and concurrently with 100 lbf/ ft. applied vertically downward.
 - b. Concentrated load of 200 lbf applied in any direction.
 - c. Uniform and concentrated loads need not be assumed to act concurrently.
 - 4. Infill of Guards:
 - a. Concentrated load of 50 lbf applied horizontally on an area of 1 sq. ft.

- b. Uniform load of 25 lbf/sq. ft. applied horizontally.
 - 1). Infill load and other loads need not be assumed to act concurrently.

1.4 SUBMITTALS

- A. Product Data: Provide manufacturer's standard catalog data for specified products demonstrating compliance with referenced standards. Provide list of fittings being provided with descriptions, load capabilities, and either photographs or drawings for each type.
- B. Shop Drawings: Submit Shop Drawings for fabrication and installation. Include the following:
 - 1. Plans, elevations, and detail sections.
 - 2. Indicate materials, methods, finishes, fittings, fasteners, anchorages, and accessory items, including all hardware.
 - 3. Provide setting diagrams and templates for anchorages, sleeves, and bolts to be installed by others.
 - 4. Where materials or fabrications are indicated to comply with design loadings, include material and safety factor properties, and other information needed for structural analysis.
- C. Calculations: Where installed metal fabrication work is indicated to comply with certain design loadings, provide professionally prepared calculations, material properties, certification, and other information required for structural analysis of performance of work.
- D. Verification Samples:
 - 1. Three samples representing actual products and finishes as follows:
 - a. Wire rope with fitting, minimum size 12 inches (300 mm) long.
 - b. Rods, minimum size 12 inches (300 mm) long.
 - c. Typical fittings.
 - 2. Workmanship Samples:
 - a. Sample bolted and welded connections, rail to post, post to base plate, wire to wire frame to post.
- E. Installation Instructions: Manufacturer's printed installation instructions.

1.5 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Company specializing in manufacturer of stainless steel wire rope, fittings, and other stainless steel components with 10 years minimum successful experience and with a record of successful in-service performance, as well as sufficient production capacity to produce required units.
- B. Installer Qualifications: Experienced in performing work of this section that has specialized in installation of work similar to that required for this project.

- C. Engineering: Provide the services of a Professional Engineer, currently registered in the State of North Carolina, to design and certify that the work of this section meets or exceeds the performance requirements specified in this section.
- D. Shop fabricate work to greatest extent possible. Label each piece in shop to facilitate field assembly.
- E. Welding Qualifications: Qualify procedures and personnel according to the following:
 - 1. AWS D1.6, "Structural Welding Code - Stainless Steel."
- F. Mockup:
 - 1. Include in place mockups as indicated on Drawings.
- G. Preinstallation Meetings: Conduct meetings including Contractor, Architect, fabricator, installer and other subcontractors whose work involves decorative metal railings to verify project requirements, supports, framing and support conditions, mounting surfaces and manufacturer's installation requirements.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Store products in manufacturer's unopened packaging until ready for installation.
- B. All individual parts and packages of identical parts are to be clearly marked for identification. The packing list shall include the description, quantity and piece mark of the parts, components and elements.
- C. Handle and store products according to manufacturer's recommendations. Leave products wrapped or otherwise protected and under clean and dry storage conditions until required for installation.
- D. Exercise care not to scratch, mark, dent, or bend metal components during delivery, storage, and installation.

1.7 PROJECT CONDITIONS

- A. Field Measurements: Verify dimensions by field measurements before fabrication and indicate measurements on Shop Drawings. Coordinate fabrication schedule with construction progress to avoid delaying the Work.
 - 1. Established Dimensions: Where field measurements cannot be made without delaying the Work, establish dimensions and proceed with fabricating without field measurements. Coordinate construction to ensure that actual dimensions correspond to established dimensions. Allow for trimming and fitting.

PART 2 - PRODUCTS

2.1 WIRE ROPE ASSEMBLIES

- A. Basis-of-Design Manufacturer: Jakob, Delray Beach, FL.
 - 1. Alternate Manufacturers: Carl Stahl, Suncor Stainless, or acceptable equivalent.
- B. Provide stainless steel wire rope assembly components as specified and as indicated on the Drawings. Manufacturer shall engineer and fabricate components and assemblies for installation. Design requirements for individual components and wire rope shall be as indicated on the Drawings. Required components include, but are not limited to, the following
 - 1. MR-03 - Metal Railing
 - a. Component: Jakob Inox Wire Webnet A-H18-1.5-W60xh106, #4 Finish
 - b. Location: Stage
 - 2. MR-04 - Metal Railing
 - a. Component: Jakob Inox Wire Webnet A-HLS-1.5-W60xh106 With Clevis Assembly, #4 Finish
 - b. Location: Follow Spot
 - 3. MR-05 - Metal Railing
 - a. Component: Jakob Inox Wire Webnet A-H18-1.5-W60xh106, #4 Finish
 - b. Location: Stage Ramp
 - 4. MR-06 - Metal Railing
 - a. Components: Jakob Inox Stainless Round-Steel Chain (080800-500) With Threaded Chain Connector (30895-0400) And Trigger Snap (30815-0055), Stainless Steel Round Chain Guardrail 3mm Dia With Detachable End
 - b. Location: Follow Spot

2.2 MATERIALS

- A. Stainless Steel:
 - 1. Castings: ASTM A 743/A 743M, Grade CF 8 or CF 20.
 - 2. Sheet, Strip, Plate, and Flat Bar: ASTM A 666, Type 304.
 - 3. Bars and Shapes: ASTM A 276, Type 304.
- B. Post-Installed Anchors: Alloy Group 1 (A1) stainless-steel bolts, ASTM F 593, and nuts, ASTM F 594.
- C. Welding Rods and Bare Electrodes: Select according to AWS specifications for metal alloy welded.

2.3 WIRE NETTING

- A. Material: Webnet as manufactured by Jakob, Inc. Parallel stainless steel wire ropes

connected by reciprocally curved offset sleeves or clamps such that ropes are neither knotted nor crossed. Wire rope shall be fabricated from cold-drawn, AISI Type 316 stainless steel wire complying with ASTM A 492 and ASTM A 555.

1. Cable Diameter x Mesh Aperture Cable: Stainless steel wire rope 7x19 construction, EN 10264-4 Type 316 joined with seamless ferrules.
 - a. 5mm cable x 60mm x 100mm Mesh Aperture.
 - b. Ferule Type: Seamless Type 316 Stainless Steel.
 - c. Rise Angle: As selected by the Architect between 29 degrees and 37 degrees.
2. Mounting System, Including:
 - a. Horseshoe Bracket.
 - b. Tube Frame Support.
 - c. Countersunk M8 Sleeve Nut.
 - d. Spacer, 200mm.
 - e. Escutcheon plate, 40mm diameter.
 - f. All other components necessary for a complete installation.
3. Fittings And Accessories:
 - a. Attachment Cable Material: Type 316 stainless steel 7x19 wire rope.
 - b. Accessories: Provide grommet, bushings, washers, swaging ferrules, studs, receivers, fittings and other components as required for system installation.

2.4 WIRE ROPE

- A. Material: ASTM A 492 and ASTM A 555, Type 316 stainless steel. Fabricate wire rope with integral colored filament designating specific manufacturer.
- B. Length: Provide wire rope tendons in lengths indicated on accepted shop drawings.
 1. Provide optimum adjustment in both directions by calculating final tendon lengths with allowance for tensioning fittings with 2/3 open and with 1/3 of thread length engaged.
 2. Measure tendon length from center of pin to center of pin, or center of eye to center of eye.

2.5 MOUNTING SPACERS/BRACKETS

- A. Provide wall mounting spacers, brackets and fittings required for attachment and connection to the structure and for support of stainless steel wire rope, wire netting, and metal rod as indicated on the Drawings.
- B. Mounting Types: Fabricate from AISI Type 316 and 316L stainless steel complying with ASTM F 1145. Provide sizes and types as required to meet project design conditions specified and indicated on Drawings.

2.6 FITTINGS AND CONNECTORS

- A. Provide fittings and connectors required for decorative metal railings and for attachment and connection of stainless steel wire rope, wire netting and metal rods to support framework and substrates.
- B. Types: Fabricate from AISI Type 316 and 316L stainless steel complying with ASTM F 1145. Provide sizes and types as required to meet project design conditions specified and indicated on Drawings and reviewed shop drawings including:
 - 1. Shop applied swaged rope ends: Threaded external and internal swivel ends, turnbuckles, tensioning screws, end stops, clevis ends, eye ends, loop ends, and end cones.
 - 2. Screwed rope ends for on-site assembly: Threaded external and internal swivel ends, turnbuckles, tensioning screws, end stops, clevis ends, eye ends, loop ends, and end cones.
 - 3. Clamps: Ring clamps, cross clamps, wire rope clamping cones, and connecting wire rope clamps.
 - 4. Post fittings: Straight, angled, and spherical
 - 5. Anchoring systems: Studs, clevis, eye end, eye bolt, slotted, spacer baskets, radial clevis holder, cross clamp with support disk, slotted rope deflector, ball cage.
- C. Accessories: Provide threaded couplings, tensioning screws, cover disks, eye bolts, eye nuts, carabineers, shackles, clips, welded rings, screws, washers, lock nuts, hexagonal nuts, dome nuts, wall anchors, screws, and wire end caps as required to complete the installation.

2.7 EXTERIOR STAINLESS STEEL RAILINGS

- A. Provide stainless steel railings as indicated and as follows:
 - 1. Material: AISI 316 stainless steel
 - 2. Finish: Brushed 320 grain.
 - 3. Anchorage: Stainless steel-bolted exterior escutcheon.

2.8 FABRICATION, GENERAL

- A. Tolerances: Verify dimensions on site prior to shop fabrication.
- B. Fabricate stainless steel in accordance with AISI Steel Product Manual and the manufacturers requirements.
- C. Assemble assemblies in the shop to greatest extent possible to minimize field splicing and assembly. Disassemble units only as necessary for shipping and handling limitations. Clearly mark units for reassembly and coordinated installation. Use connections that maintain structural value of joined pieces.
- D. Make up wire-rope assemblies in the shop to field-measured dimensions with fittings machine swaged. Minimize amount of turnbuckle take-up used for dimensional

adjustment so maximum amount is available for tensioning wire ropes. Tag wire-rope assemblies and fittings to identify installation locations and orientations for coordinated installation.

- E. 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.
- F. Form work true to line and level with accurate angles and surfaces.
- G. Fabricate connections that will be exposed to weather in a manner to exclude water. Provide weep holes where water may accumulate. Locate weep holes in inconspicuous locations.
- H. Cut, reinforce, drill, and tap as indicated to receive finish hardware, screws, and similar items.
- I. Provide inserts and other anchorage devices for connecting railings to concrete or masonry work. Fabricate anchorage devices capable of withstanding anticipated imposed loads. Coordinate anchorage devices with supporting structure.
- J. Coordinate requirements, dimensions and spacing of decorative metal railings to ensure required factory drilled holes in supporting framework are correctly located.
- K. Fabricate connections that will be exposed to weather in a manner to exclude water. Provide weep holes where water may accumulate.

2.9 STAINLESS-STEEL FINISHES

- A. After fabrication, clean and de-scale stainless steel wire rope, fittings, and other components in accordance with ASTM A 380.
- B. Finish components with AISI No. 4 brushed satin finish in accordance with ASTM B 912.

PART 3 - EXECUTION

3.1 PREPARATION

- A. Coordinate and furnish anchorage devices, setting drawings, diagrams, templates, instructions, and directions for installation of concrete inserts, sleeves, anchor bolts, and miscellaneous items to be embedded or attached to concrete work, masonry work, or structural steel work.

3.2 INSTALLATION, GENERAL

- A. Fastening to In-Place Construction: Provide anchorage devices and fasteners necessary for securing work of this Section to in-place construction. Include threaded fasteners for concrete and masonry inserts, and other connectors required.

- B. Cutting, Fitting, and Placement: Perform cutting, drilling, and fitting required for installation of work of this Section.
- C. Erect work square, plumb and true, accurately fitted, and with tight joints and intersections. Avoid field cutting or drilling to greatest extent possible.
- D. Brace work rigid and secure to surrounding construction. Provide temporary bracing or anchors where required.
- E. Fit exposed connections accurately together to form hairline joints. Shop weld connections, except when work cannot be shop welded due to shipping size or galvanizing limitations.
- F. Field Welding: Comply with AWS D1.1 and AWS D1.2 for procedures of manual metal-arc welding, appearance and quality of welds, and correction methods for defective welds.

3.3 PROTECTION

- A. Protect finishes from damage during construction period with temporary protective coverings approved by manufacturer. Remove protective coverings at time of Substantial Completion.
- B. Restore finishes damaged during installation and construction period so no evidence remains of correction work. Return items that cannot be refinished in the field to the shop; make required alterations and refinish entire unit, or provide new units.

3.4 WASTE MANAGEMENT

- A. Separate and dispose of waste in accordance with the Project's Waste Management Plan.

END OF SECTION

SECTION 061053 - MISCELLANEOUS ROUGH CARPENTRY

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes the following:
 - 1. Wood blocking and nailers.
 - 2. Wood furring.
 - 3. Plywood backing panels.
- B. Related Documents and Sections: Examine Contract Documents for requirements that directly affect or are affected by Work of this Section. A list of those Documents and Sections include, but is not limited to the following:
 - 1. Drawings and general provisions of the Contract, including General and Supplementary Conditions, and Division 01 General Requirements Specification Sections, apply to this Section.
 - 2. Section 061600 - SHEATHING for gypsum sheathing.
 - 3. Division 07 roofing sections for wood blocking and nailers associated with roofing, and for plywood substrates for flashing at parapets.

1.2 DEFINITIONS

- A. Dimension Lumber: Lumber of 2 inches nominal or greater but less than 5 inches nominal in least dimension.
- B. Lumber grading agencies, and the abbreviations used to reference them, include the following:
 - 1. NeLMA: Northeastern Lumber Manufacturers' Association.
 - 2. NHLA: National Hardwood Lumber Association.
 - 3. NLGA: National Lumber Grades Authority.
 - 4. SPIB: The Southern Pine Inspection Bureau.

1.3 SUBMITTALS

- A. Research/Evaluation Reports: For the following, showing compliance with building code in effect for Project:
 - 1. Preservative-treated wood.
 - 2. Fire-retardant-treated wood.

1.4 QUALITY ASSURANCE

- A. Forest Certification: For miscellaneous lumber, provide materials produced from wood obtained from forests certified by an FSC-accredited certification body to comply with FSC 1.2, "Principles and Criteria":

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Stack lumber flat with spacers between each bundle to provide air circulation. Provide for air circulation around stacks and under coverings.
- B. Deliver interior wood materials that are to be exposed to view only after building is enclosed and weatherproof, wet work other than painting is dry, and HVAC system is operating and maintaining temperature and humidity at occupancy levels.

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. 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 lumber.
 - 3. Provide dressed lumber, S4S, unless otherwise indicated.

2.2 WOOD-PRESERVATIVE-TREATED MATERIALS

- A. Preservative Treatment by Pressure Process: AWPAC2.
 - 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 nailers, curbs, equipment support bases, blocking, stripping, and similar members in connection with flashing, vapor barriers, and waterproofing.
 - 2. Wood sills, sleepers, blocking, furring, 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 crawl spaces or unexcavated areas.
5. Wood floor plates that are installed over concrete slabs-on-grade.

2.3 FIRE-RETARDANT-TREATED MATERIALS

- A. General: Comply with performance requirements in AWPA C20 (lumber) and AWPA C27 (plywood).
 1. Use treatment that does not promote corrosion of metal fasteners.
 2. Use Interior Type A or Exterior type.
- B. Identify fire-retardant-treated wood with appropriate classification marking of testing and inspecting agency acceptable to authorities having jurisdiction.
 1. For exposed lumber indicated to receive a stained or natural finish,
- C. For exposed items indicated to receive a stained or natural finish, use chemical formulations that do not bleed through, contain colorants, or otherwise adversely affect finishes.
- D. Application: Treat items indicated on Drawings, and the following:
 1. Concealed blocking.
 2. 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. Furring.
- B. For items of dimension lumber size, provide Construction or No. 2 grade lumber with 19 percent maximum moisture content and any species.
- C. For concealed boards, provide lumber with 19 percent maximum moisture content and any of the following species and grades:
 1. Mixed southern pine, No. 2 3 grade; SPIB.
 2. Hem-fir or hem-fir (north), Construction or 2 Common grade; NLGA, WCLIB, or WWPA.
 3. Spruce-pine-fir (south) or spruce-pine-fir, Construction or 2 Common grade; NeLMA, NLGA, WCLIB, or WWPA.

- D. 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.

2.5 PLYWOOD BACKING PANELS

- A. Backing Panels for Electrical, Audio-Visual, Data, And Telephone Equipment: DOC PS 1, Exposure 1, C-D Plugged, 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 A 153/A 153M, or of Type 304 stainless steel.
- B. Nails, Brads, and Staples: ASTM F 1667.
- C. Power-Driven Fasteners: NES NER-272.
- D. Wood Screws: ASME B18.6.1.
- E. Screws for Fastening to Cold-Formed Metal Framing: ASTM C 954, except with wafer heads and reamer wings, length as recommended by screw manufacturer for material being fastened.
- F. Lag Bolts: ASME B18.2.1.
- G. Bolts: Steel bolts complying with ASTM A 307, Grade A; with ASTM A 563 hex nuts and, where indicated, flat washers.
- H. Expansion Anchors: Anchor bolt and sleeve assembly of material indicated below with capability to sustain, without failure, a load equal to 6 times the load imposed when installed in unit masonry assemblies and equal to 4 times the load imposed when installed in concrete as determined by testing per ASTM E 488 conducted by a qualified independent testing and inspecting agency.
 - 1. Material
 - a. Interior: Carbon-steel components, zinc plated to comply with ASTM B 633, Class Fe/Zn 5.
 - b. Exterior: Stainless steel with bolts and nuts complying with ASTM F 593 and ASTM F 594, Alloy Group 1 or 2.

PART 3 - EXECUTION

3.1 INSTALLATION, GENERAL

- A. Set carpentry to required levels and lines, with members plumb, true to line, cut, and fitted. Fit carpentry to other construction; scribe and cope as needed for accurate fit. Locate furring, nailers, blocking, and similar supports to comply with requirements for attaching other construction.
- B. Do not splice structural members between supports, unless otherwise indicated.
- C. Provide blocking and framing as indicated and as required to support facing materials, fixtures, specialty items, and trim.
- D. Sort and select lumber so that natural characteristics will not interfere with installation or with fastening other materials to lumber. Do not use materials with defects that interfere with function of member or pieces that are too small to use with minimum number of joints or optimum joint arrangement.
- E. Comply with AWPAC M4 for applying field treatment to cut surfaces of preservative-treated lumber. Use copper naphthenate.
- F. Securely attach carpentry work to substrate.

3.2 WOOD BLOCKING AND NAILER INSTALLATION

- A. Install where indicated and where required for attaching other work. Form to shapes indicated and cut as required for true line and level of attached work. Coordinate locations with other work involved.
 - 1. Provide wood blocking in non-fire-rated partitions, accurately positioned and firmly secured to metal studs, to support handrails, guardrails, aluminum wall plate, fixtures, equipment, services, casework, visual display boards, lockers, heavy trim, grab bars, toilet accessories, furnishings, and similar work requiring attachment to framing, whether or not such blocking is indicated on Drawings.
 - 2. Coordinate with Section 092116 - GYPSUM BOARD ASSEMBLIES.
- B. Attach items to substrates to support applied loading. Recess bolts and nuts flush with surfaces, unless otherwise indicated.
- C. Install furring level and plumb with closure strips at edges and openings. Shim with wood as required for tolerance of finish work.

3.3 WASTE MANAGEMENT

- A. Separate and dispose of waste in accordance with the Project's Waste Management Plan.

END OF SECTION

SECTION 061063 - EXTERIOR ROUGH CARPENTRY

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. Wood.
- B. Related Requirements:
 - 1. Section 061533 "Wood Decking."

1.3 DEFINITIONS

- A. Boards: Lumber of less than 2 inches nominal in thickness and 2 inches nominal or greater in width.
- B. Dimension Lumber: Lumber of 2 inches nominal or greater but less than 5 inches nominal in least dimension.
- C. Timber: Lumber of 5 inches nominal or greater in least dimension.
- D. Lumber grading agencies, and the abbreviations used to reference them, include the following:
 - 1. NeLMA: Northeastern Lumber Manufacturers' Association.
 - 2. NLGA: National Lumber Grades Authority.
 - 3. RIS: Redwood Inspection Service.
 - 4. SPIB: The Southern Pine Inspection Bureau.
 - 5. WCLIB: West Coast Lumber Inspection Bureau.
 - 6. WWPAA: Western Wood Products Association.

1.4 ACTION SUBMITTALS

- A. Product Data: For preservative-treated wood products. Include chemical treatment manufacturer's written instructions for handling, storing, installing, and finishing treated material.

1.5 INFORMATIONAL SUBMITTALS

- A. Material Certificates:
 - 1. For preservative-treated wood products. Indicate type of preservative used and net amount of preservative retained. For products receiving a waterborne treatment, include statement that

moisture content of treated materials was reduced to levels specified before shipment to Project site.

- B. Certificates of Inspection: Issued by lumber grading agency for exposed wood products not marked with grade stamp.
- C. Evaluation Reports: For preservative-treated wood products, from ICC-ES.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Store materials under cover and protected from weather and contact with damp or wet surfaces. Stack lumber flat with spacers between each bundle to provide air circulation. Provide for air circulation around stacks and under coverings.

PART 2 - PRODUCTS

2.1 LUMBER, GENERAL

- A. Comply with DOC PS 20 and with grading rules of lumber grading agencies certified by ALSC's Board of Review as applicable. If no grading agency is indicated, comply with the applicable rules of any rules-writing agency certified by ALSC's Board of Review.
 - 1. Factory mark each item with grade stamp of grading agency.
 - 2. For items that are exposed to view in the completed Work, 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. Provide dressed lumber, S4S, unless otherwise indicated.
- B. Maximum Moisture Content:
 - 1. Boards: 15 percent.
 - 2. Dimension Lumber: 15 percent for 2-inch nominal thickness or less; 19 percent for more than 2-inch nominal thickness.
 - 3. Timber: 19 percent.

2.2 LUMBER

- A. Hand select wood for freedom from characteristics, on exposed surfaces and edges, that would impair finish appearance, including decay, honeycomb, knot holes, shake, splits, torn grain, and wane.
- B. Dimension Lumber at Boardwalk:
 - 1. Grade: Select Structural.
 - 2. Southern pine; SPIB.
- C. Dimension Lumber at Stage (Louvers): Select Structural the following species:
 - 1. Grade: Select Structural.

2. Western Cedar; WWP.A.

- D. Dimension Lumber at Stage (2x4 Framing to Support Plywood): Select Structural the following species:
 1. Grade: No. 2.
 2. Southern pine; SPIB.

2.3 PRESERVATIVE TREATMENT

- A. Pressure treat with chromated copper arsenate (CCA) to a 0.4 percent retention.
- B. After treatment, redry dimension lumber to 19 percent maximum moisture content.
- C. Mark treated wood with treatment quality mark of an inspection agency approved by ALSC's Board of Review.
- D. Application: Treat all wood unless otherwise indicated.

2.4 FASTENERS

- A. General: Provide fasteners of size and type indicated, acceptable to authorities having jurisdiction, and that comply with requirements specified in this article for material and manufacture. Provide nails or screws, in sufficient length, to penetrate not less than 1-1/2 inches into wood substrate.

1. Use stainless steel unless otherwise indicated.

- B. Nails: ASTM F 1667.
- C. Power-Driven Fasteners: ICC-ES AC70.
- D. Wood Screws and Lag Screws: ASME B18.2.1, ASME B18.6.1, or ICC-ES AC233.
- E. Stainless-Steel Bolts: ASTM F 593, Alloy Group 1 or 2 with ASTM F 594, Alloy Group 1 or 2 hex nuts and, where indicated, flat washers.
- F. Postinstalled Anchors: Stainless-steel, anchors with capability to sustain, without failure, a load equal to 6 times the load imposed when installed in unit masonry assemblies and equal to 4 times the load imposed when installed in concrete as determined by testing according to ASTM E 488, conducted by a qualified independent testing and inspecting agency.
 1. Stainless-steel bolts and nuts complying with ASTM F 593 and ASTM F 594, Alloy Group 1 or 2.

2.5 METAL ACCESSORIES

- A. Stainless-Steel Sheet: ASTM A 666, Type 304.

3.1 INSTALLATION, GENERAL

- A. Set work to required levels and lines, with members plumb, true to line, cut, and fitted. Fit work to other construction; scribe and cope as needed for accurate fit.
- B. Framing Standard: Comply with AF&PA WCD1 unless otherwise indicated.
- C. Install metal framing anchors to comply with manufacturer's written instructions.
- D. Do not splice structural members between supports unless otherwise indicated.
- E. Provide blocking and framing as indicated and as required to support facing materials, fixtures, specialty items, and trim.
- F. Sort and select lumber so that natural characteristics do not interfere with installation or with fastening other materials to lumber. Do not use materials with defects that interfere with function of members or pieces that are too small to use with minimum number of joints or optimum joint arrangement.
- G. Apply copper naphthenate field treatment to comply with AWPAC M4, to cut surfaces of preservative-treated lumber.
- H. 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. "Fastener Schedule for Structural Members" and "Alternate Attachments" in ICC's International Residential Code for One- and Two-Family Dwellings.
- I. Use common wire nails unless otherwise indicated. Select fasteners of size that do not fully penetrate members where opposite side is exposed to view. Make tight connections between members. Install fasteners without splitting wood; do not countersink nail heads unless otherwise indicated.

END OF SECTION 061063

SECTION 061600 - SHEATHING

PART 1 - GENERAL

1.1 SUMMARY

- A. Work Included: Provide labor, materials and equipment necessary to complete the work of this Section, including but not limited to the following:
 - 1. Glass-mat gypsum sheathing at exterior wall.
- B. Related Documents and Sections: Examine Contract Documents for requirements that directly affect or are affected by Work of this Section. Other Documents and Sections that directly relate to work of this Section include, but are not limited to:
 - 1. General provisions of the Contract, including General and Supplementary Conditions, and Division 01 General Requirements Specification Sections.
 - 2. Section 072500 - WEATHER BARRIERS.
 - 3. Section 076200 - SHEET METAL FLASHING AND TRIM.

1.2 SYSTEM DESCRIPTION

- A. Definitions:
 - 1. Gypsum Board Construction Terminology Standard: Refer to ASTM C 11 and GA-505 for definitions of terms for gypsum sheathing board construction not defined in this Section or in other referenced standards.

1.3 SUBMITTALS

- A. Product Data: Submit manufacturer current technical literature for each type of product indicated. Indicate component materials and dimensions and include construction and application details.
- B. Quality Assurance Submittals:
 - 1. Design Data, Test Reports: Provide manufacturers test reports indicating product compliance with indicated requirements.
 - 2. Manufacturers Instructions: Provide manufacturers written installation instructions.

1.4 QUALITY ASSURANCE

- A. Source Limitations: Obtain each gypsum sheathing product through one source from a single manufacturer.
- B. Fire-Resistance-Rated Assemblies: Where gypsum sheathing boards are part of fire-resistance-rated assemblies, provide assemblies as follows:

1. Assemblies comply with requirements of fire-response-tested assemblies indicated by GA File Numbers in GA-600, "Fire Resistance Design Manual"; or by design designations in UL's "Fire Resistance Directory" or in certification listings of another testing and inspecting agency acceptable to authorities having jurisdiction.
2. Fire-resistance ratings were determined by fire-response testing assemblies according to ASTM E 119.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Deliver materials in original packages, containers, or bundles, each bearing brand name and identification of manufacturer.
- B. Store materials protected against damage from weather, direct sunlight, surface contamination, corrosion, construction traffic, or other causes. Neatly stack gypsum sheathing board flat on leveled supports off the ground, under cover, and fully protected from weather.

1.6 SEQUENCING AND SCHEDULING

- A. Sequence installing sheathing with installing exterior cladding to comply with requirements indicated below:
 1. Do not leave glass-mat gypsum sheathing board exposed to weather for more than 180 days.

PART 2 - PRODUCTS

2.1 GLASS-MAT GYPSUM SHEATHING BOARD

- A. Glass-Mat Gypsum Sheathing Board: ASTM C1177.
 1. Size: 48 by 96 inches minimum.
 2. Surfacing: Coated glass mat on face, back, and long edges.
 3. Racking Strength (Ultimate, not design value) (ASTM E72): Not less than 540 pounds per square foot, dry.
 4. Flexural Strength, Parallel (ASTM C473): 80 lbf, parallel.
 5. Humidified Deflection (ASTM C1177): Not more than 1/4 inch.
 6. Permeance (ASTM E96): 23 perms.
 7. R-Value (ASTM C518): 0.56.
- B. Sheathing Manufacturers:
 1. Acceptable manufacturers/products include, but are not limited to:
 - a. CertainTeed Corporation; GlasRoc.
 - b. G-P Gypsum Corporation; Dens-Glass Gold.
 - c. National Gypsum Company; Gold Bond e(2)XP.
 - d. Temple-Inland Inc.; GreenGlass

- e. United States Gypsum Co.; Securock.
- 2. Basis-of-Design: Georgia-Pacific Corporation, "Dens-Glass Gold."
- 3. Type "X"
- 4. Thickness: 5/8 inch standard.
- 5. Edges: Square.

2.2 GYPSUM FASTENERS

- A. General: Provide fasteners of size and type indicated that comply with requirements specified in this Article for material and manufacture.
 - 1. For wall sheathing, provide fasteners with hot-dip zinc coating complying with ASTM A153/A153M.
- B. Screws for Fastening Gypsum Sheathing to Cold-Formed Metal Framing: Steel drill screws, in length recommended by sheathing manufacturer for thickness of sheathing board to be attached, with organic-polymer or other corrosion-protective coating having a salt-spray resistance of more than 800 hours according to ASTM B117.
 - 1. For non-load-bearing steel framing from 0.033 to 0.112 inch thick, attach sheathing with drill screws complying with ASTM C954.

2.3 WOOD PANEL SHEATHING

- A. Plywood: Manufacture in accordance with American Plywood Association (APA) standards, marking each sheet grade.
 - 1. Comply with USDC PS 1-07, PS 2-04, and APA PDS-97 as applicable. Factory mark each panel with APA trademark showing compliance with requirements.
- B. Factory mark panels to indicate compliance with applicable standard.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. General: Install gypsum sheathing to comply with GA-253 and manufacturer's written instructions.
- B. Cut boards at penetrations, edges, and other obstructions of the work; fit tightly against abutting construction, except provide a 3/8-inch setback where non-load-bearing construction abuts structural elements.
- C. Coordinate sheathing installation with flashing and joint sealant installation so these materials are installed in the sequence and manner that prevent exterior moisture from passing through completed exterior wall assembly.
- D. Apply fasteners so screw heads bear tightly against face of sheathing boards but do not cut into facing.

- E. Do not bridge building expansion joints with sheathing; cut and space edges to match spacing of structural support elements.
- F. Vertical Installation: Install 48-inch- wide gypsum sheathing boards vertically with vertical edges centered over flanges of steel studs. Abut ends and edges of each board with those of adjacent boards. Screw-attach boards at perimeter and within field of board to each steel stud:
 - 1. Perimeter: 6 inches on center.
 - 2. Field: 8 inches on center.

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, UNO in the Structural Drawings:
 - 1. Roof Sheathing: Nail or staple to wood framing. Screw to cold-formed metal framing.

3.3 WASTE MANAGEMENT

- A. Separate and dispose of waste in accordance with the Project's Waste Management Plan.

END OF SECTION

SECTION 062013 - EXTERIOR FINISH CARPENTRY

PART 1 - GENERAL

1.1 SUMMARY

- A. Provide exterior finish carpentry:
 - 1. Wood louvers at exterior canopy.
 - 2. Cedar cladding to roof terrace bench.
- B. Related Documents and Sections: Examine Contract Documents for requirements that directly affect or are affected by Work of this Section. A list of those Documents and Sections include, but is not limited to the following:
 - 1. Drawings and general provisions of the Contract, including General and Supplementary Conditions and General Requirements, Division 01 Specification Sections, apply to this Section.
 - 2. Section 051200 - STRUCTURAL STEEL FRAMING.
 - 3. Section 076200 - SHEET METAL FLASHING AND TRIM.
 - 4. Section 099100 - PAINTING.
- C. Work of this Section is affected by Alternates. Refer to Section 012305 - ARCHITECTURAL ALTERNATES.

1.2 SUBMITTALS

- A. Product Data: Submit manufacturer's printed product data, specifications, standard details, installation instructions, use limitations and recommendations for each material used. Provide certifications that materials and systems comply with specified requirements.
- B. Shop Drawings: Show pieces, dimensions, methods of assembly, fasteners, tolerances, finishes, final appearance, anchoring requirements, installation methodology, and coordination with other Work.
 - 1. Details to allow for constant radial and tangential material movements of each piece in each wood assembly due to:
 - a. Temperature changes.
 - b. Exposure to elements.
 - c. Seasonal variation.
- C. Samples:
 - 1. Preliminary Samples:
 - a. Minimum 12" x 12" or 12" lengths to show patterns, color ranges, and types, as applicable, of the material proposed to be used.

2. Samples for Verification: For each species and cut of lumber and panel products, with 1/2 of exposed surface finished; 50 sq. in. for lumber and 16 by 16 inches for panels. Furnish samples of greater size or quantity where required to show expected range of finish in the completed work.

D. Quality Assurance Submittals

1. Manufacturer's Certificates: Certificate of Inspection for grade-marked material by American Lumber Standards (ALSC) recognized inspection agency.
2. Manufacturer/Supplier Certificate:
 - a. Grade Certificates
 - b. Moisture Content Certificates
3. Manufacturer's certificates (approved by an American Lumber Standards (ALSC) approved agency).
4. Certificate of Inspection for grade marked material by (ALSC) recognized inspection agency.

1.3 QUALITY ASSURANCE

- A. Work shall be in accordance with the Grade or Grades specified of the Architectural Woodwork Standards.
- B. Mockups: Build mockup of wood louvers at Park Support Canopy to verify selections made under Sample submittals and to demonstrate aesthetic effects and set quality standards for fabrication and installation.
 1. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Architect specifically approves such deviations in writing.
 2. Approved mockups may become part of the completed Work if undisturbed at time of Material Completion.
- C. Pre-installation Conference: Purpose is to review installation procedures.
 1. Attendees: Architect, Contractor.

1.4 DELIVERY, STORAGE, AND HANDLING

- A. Protect materials against weather and contact with damp or wet surfaces. Stack lumber, plywood, and other panels flat with spacers between each bundle to provide air circulation. Provide for air circulation within and around stacks and under temporary coverings.

PART 2 - PRODUCTS

2.1 MATERIALS, GENERAL

- A. Lumber: DOC PS 20.

- B. Factory mark each piece of lumber with grade stamp of inspection agency indicating grade, species, moisture content at time of surfacing, and mill.
 - 1. 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 inspection agency.

2.2 MATERIALS

- A. General: Finger joint material is not acceptable.
- B. Species, Grade:
 - 1. Western Red Cedar (*Thuja Plicata*), clear heart grade.

2.3 FIRE TREATED WOOD

- A. Provide Western Red Cedar dimensional lumber and sheet goods with Western Red Cedar faces which have been treated with fire resistant chemicals.
 - 1. Manufacturer: Products shall be Exterior Fire-X as manufactured by Hoover Treated Wood Products:
 - a. Wood shall be kiln dried to maximum moisture content of 19% for lumber and 15% for plywood.
 - b. Lumber and plywood shall use design value adjustments and span ratings as published by the manufacturer.
 - c. Fire-retardant treatment shall be free of halogens, sulfates, chlorides, ammonium phosphate, and contain no added urea formaldehyde.
 - d. Plywood shall have a minimum bond durability of Exposure 1 in accordance with US Product Standard PS 1, Construction and Industrial Plywood.
- B. Product Information:
 - 1. Lumber shall have a flame spread index of 25 or less (Class A) when tested in accordance with ASTM E84, "Standard Test Method for Surface Burning Characteristics of Building Materials."
 - 2. Fire-retardant-treated wood shall show no evidence of significant progressive combustion when the test is extended for an additional 20-minute period. The flame front does not progress more than 10-1/2 feet beyond the centerline of the burners at any time during the test. Surface burning characteristics for each species and product shall be listed by Underwriters Laboratories (UL).
 - 3. Fire-retardant-treated wood shall show no increase in the listed classification when evaluated for flame spread after testing in accordance with ASTM D2898 "Standard Test Methods for Accelerated Weathering of Fire-Retardant-Treated Wood for Fire Testing."
 - 4. Lumber and plywood shall be manufactured under the independent third-party inspection of Underwriters Laboratories Inc. (UL) Follow-Up Service and each piece shall bear the UL classified mark indicating the extended 30 minute ASTM E84 test and no increase in classification after ASTM D2898.
 - 5. Fire-retardant-treated wood shall be kiln dried after treatment (KDAT). The kiln

drying process shall be monitored by Timber Products Inspection, Inc. (TP).

6. Fire-retardant-treated wood shall meet the performance requirements of AWPAC U1, Specification H for Use Category UCFB (fire protection, exterior, above ground) and AWPAC C20/C27 (Exterior Type).

2.4 ACCESSORIES

A. Fasteners:

1. Screws and Anchors: 18-8 stainless steel, #1 trim head finishing screw with square drive, type 17.
2. Nails: Type 316 stainless steel, ring shank, finish nail, provide length and gauge suitable for installation.

- ### B. Installation Adhesive for Foam Plastic Moldings: Product recommended for indicated use by foam plastic molding manufacturer.

2.5 SHOP PRE-FINISHING

- ### A. Finishes for Western Red Cedar Louvers: Treated on all surfaces with a penetrating oil-based sealer that includes a mildewcide/fungicide, WOODguard Clear Oil-Based Exterior Finish or equal.
- ### B. Raw wood surfaces of field-cut members shall receive the same finish in the field.

PART 3 - EXECUTION

3.1 SPECIFIC INSTRUCTIONS

- ### A. Important Note: No attempt is made in the following specific instructions to list all elements of exterior finish carpentry required on this project. It is the responsibility of the Contractor to determine for itself from the Drawings the scope and nature of the work required. These specific instructions are intended only to provide additional instructions regarding those portions of the exterior finished carpentry for which information beyond that given on the Drawings or covered in the AWS Quality Standards seems needed to properly describe the work. Where the scope of a category is listed it is done in a general manner to assist the Contractor in determining the general nature of work he shall look for as being required in said category, and not to limit the work.

3.2 EXTERIOR FINISH CARPENTRY WORK

- ### A. Fabricate and install exterior finish carpentry work in accordance with the Drawings, the specifications, and AWS Quality Standards applicable or referenced to this work.
- ### B. Sort and select lumber so that natural characteristics do not interfere with installation or with fastening other materials to lumber. Do not use materials with defects that interfere with function of members or pieces that are too small to use with minimum number of joints or optimum joint arrangement.

- C. Install wood decking with crown up (bark side down).
- D. Secure railings with concealed metal brackets and in accordance with manufacturer's instructions.
- E. Miscellaneous Items: Install all required standing and running trim and other miscellaneous items throughout, as indicated on the Drawings and as required to satisfactorily complete the entire work, whether or not each and every required piece is specifically indicated on the Drawings. Trim shall be of same material and finish as the larger member to which applied.

3.3 COMPLETION

- A. Just prior to completion of work of this Section, inspect work in the company of Architect and make adjustments and corrections to work leaving operating parts in perfect operating condition, all jointing to adjacent material tight, all surfaces without blemishes or stains, all work properly executed and complete, and all defects and damaged work replaced or corrected.

3.4 INSTALLATION TOLERANCES

- A. The Work shall be erected plumb (or at the angles prescribed) and true in proper alignment and relation to established lines and grids as shown on the Working Drawings. The erected system shall present true and accurate lines and flat planes. All the above shall be measured from a laser reference line.
 - 1. Level and plumb: The works shall be within $\pm 1/16$ in. in 6 ft. of level and plumb.
 - 2. The permissible deviation in level of surface of wood flooring from datum shall be $\pm 1/8$ in. but shall be flush with any adjacent floor finishes.
- B. The Work, when installed, shall not be subject to warping or twisting and shall be strictly rigid and firm.

3.5 WASTE MANAGEMENT

- A. Separate and dispose of waste in accordance with the Project's Waste Management Plan.

END OF SECTION

SECTION 064023 - INTERIOR ARCHITECTURAL WOODWORK

PART 1 - GENERAL

1.1 SUMMARY

- A. Work of this Section consists of architectural woodwork, and includes but is not limited to the following:
 - 1. Solid-surface countertops.
 - 2. Plastic laminate countertops.
- B. Related Documents and Sections: Examine Contract Documents for requirements that directly affect or are affected by Work of this Section. A list of those Documents and Sections includes, but is not limited to the following:
 - 1. Drawings and general provisions of the Contract, including General and Supplementary Conditions and General Requirements, and Division 01 Specification Sections.
 - 2. Section 055000 - METAL FABRICATIONS.
 - 3. Section 061053 - MISCELLANEOUS ROUGH CARPENTRY.
 - 4. Section 092900 - GYPSUM BOARD.
 - 5. Division 21 - PLUMBING.
 - 6. Division 26 - ELECTRICAL.

1.2 SYSTEM DESCRIPTION

- A. References:
 - 1. Minimum standards for work in this Section shall be in conformity with the Architectural Woodwork Standards (AWS).
 - 2. ANSI / BHMA Standards.

1.3 SUBMITTALS

- A. Product Data: Submit manufacturer's printed product data, specifications, standard details, installation instructions, use limitations and recommendations for each material used.
 - 1. Provide certifications that materials and systems comply with specified requirements.
 - 2. Composite Lumber and Agrifiber Products: Submit product data verifying no added urea formaldehyde.
- B. Woodwork Quality Standard Compliance Certificates: AWS Quality Certification Program certificates.

C. Fabricated Samples for Verification:

1. Transparent Finished Fabricated Samples: Submit for each type of specie showing full range of grain, color, texture and finish expected in completed Work.
 - a. Handrails: 18 inch long by full profile sections of each type of wood handrail, for each required profile and finish.
 - b. Paneling: 18 inch square by full depth corner samples for each required profile and finish.
 - 1). Provide 3 Fabricated Samples for paneling, for coordination with other trades and fabrications using wood veneer furnished by this Section.

D. Shop Drawings: Submit in conformance with the requirements of the Architectural Woodwork Standards.

1. Submit two copies, one of which will be returned with reviewed notations. Make corrections noted (if any), and distribute required copies prior to the start of work.
 - a. Shop drawings shall include fabrication drawings for air panel system, including module construction, method of attachment, trims, backup framing, and all other items necessary for a complete installation.
2. Field Measurements: Take necessary field measurements prior to preparation of Shop Drawings.
 - a. Record measurements on Shop Drawings.
 - b. Coordinate field measurements and fabrication schedule with construction progress to avoid construction delays.
 - 1). Do not delay progress of job. If field measurements are not possible prior to fabrication, allow for field scribing for fitting.

E. Samples:

1. Finishes: Submit four finished samples of each species and cut of wood to be used. Lumber samples to be minimum 6 by 12 inches, and plywood samples to be minimum 12 by 12 inches. Samples shall represent the range of color and grain expected to be provided.
2. Hardware: Submit a sample in the specified finish of each hardware item that will be visible at exposed surfaces when the job is complete.
3. Air Panel: Provide 12 in. long sample of metal trim, 12 in. x 12 in. sample of mesh.

F. Quality Assurance Submittals

1. Test Reports: Submit certified test results by a recognized testing laboratory in accordance with specified test methods for each product and/or system indicating physical, chemical and performance characteristics.
2. Manufacturer's Certificates: Certificate of Inspection for grade-marked material by American Lumber Standards (ALSC) recognized inspection agency.
 - a. Certificates of Grade for graded but unmarked lumber or plywood.
 - b. Moisture Content Certificates.
 - c. Laminated Plastics.
 - d. Casework manufacturer's AWS Quality Assurance Program Certification.

- 1). In lieu of Certification, approved manufacturer shall agree to and understand that the Work furnished for this Project will be inspected by an Association program representative.

1.4 QUALITY ASSURANCE

- A. Work shall be in accordance with the Grade or Grades specified of the Architectural Woodwork Standards.
- B. AWS Quality Assurance Program.
- C. Fabricator Qualifications:
 1. Woodwork firm with no less than 5 years of production experience similar to a specific project, whose qualifications indicate the ability to comply with the requirements of this Section.
 2. The woodwork manufacturer must have at least one project in the past 5 years where the value of the woodwork was within 20 percent of the cost of woodwork for this Project.
- D. Single Source Responsibility: A single manufacturer for each type of casework specified shall provide and install the work of described in this Section.
- E. Mockup: Prior to fabricating architectural woodwork, construct sample items to verify selections made under sample submittals and to demonstrate aesthetic effects as well as other qualities of materials and execution. Build mockups to comply with the following requirements, using materials and finish indicated for final unit of Work.
 1. Provide mockups of one base cabinet, one wall hung cabinet, and one countertop. Base cabinet shall have at least one drawer. The Approved Mockup may be incorporated in the project.
 2. Provide mockup of one Air Panel wall module, demonstrating construction, finish, joinery, trim, methods of attachment and mounting.
 3. Provide mockup of one Air Panel ceiling module, demonstrating construction, finish, joinery, trim, methods of attachment and mounting.
- F. Preinstallation Meeting: Convene a pre-installation conference to establish procedures to maintain optimum working conditions and coordinate this Work with related and adjacent Work. Require attendance of architectural woodwork manufacturer, Installer, Contractor, and Architect.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Deliver materials only when the project is ready for installation and the general contractor has provided a clean storage area.
 1. Delivery of architectural millwork shall be made only when the area of operation is enclosed, all plaster and concrete work is dry and the area broom clean.

1.6 PROJECT CONDITIONS

- A. Environmental Limitations: Maintain indoor temperature and humidity within the range recommended by the Architectural Woodwork Standards for the location of the project.
 - 1. Maintain an interior relative humidity every hour of every day, within the following ranges:
 - a. 25 to 55%.
- B. Field Measurements: Where woodwork is indicated to fit to other construction, verify dimensions of other construction by field measurements before fabrication and indicate measurements on Shop Drawings. Coordinate fabrication schedule with construction progress to avoid delaying the Work.
 - 1. Locate concealed framing, blocking, and reinforcements that support woodwork by field measurements before being enclosed and indicate measurements on Shop Drawings.
- C. Woodworker is responsible for the layout of any partition and area containing woodwork and shall layout and coordinate with all other trades as to ensure proper coordination.

1.7 WARRANTY

- A. All architectural woodwork is guaranteed to be of good material and workmanship and free from defects that render it unserviceable for the use for which it is intended. Natural variations in the color or texture of the wood are not to be considered defects. The quality of architectural woodwork is safeguarded while it is in the manufacturer's possession. To be protected by this guarantee, products must not be stored in damp warehouses or placed in moist or freshly plastered buildings. The woodwork must not be subjected to abnormal heat or dryness. Permanent-type heat and air conditioning must be in operation a sufficient length of time to "cure" the building before any woodwork or doors are delivered to the site.
- B. Adhere to the requirements below for range and maintenance of relative humidity. Acclimatize delivered woodwork to the job site for a minimum of 72 hours before installation. Factory-finished woodwork requires up to a week or more on site for acclimatization.
- C. Woodwork must be inspected upon arrival, and all claims or complaints must be filed before installation. The manufacturer will not be responsible for defects resulting from neglect of these precautions.
- D. The manufacturer agrees, within a period of two (2) years after delivery date, to repair or replace without charge any woodwork that is defective within the meaning of this guarantee. The manufacturer does not agree to be responsible for any work that was not originally performed by them. The manufacturer shall agree to pay charges for finishing or installing replaced woodwork. This guarantee is not effective if goods are repaired or replaced without first obtaining the manufacturer's written consent.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. General: Lumber shall be in accordance with the Architectural Woodwork Standards Grade specified for the product being fabricated. Moisture Content shall be 6% to 9% for boards of any thickness.
 - 1. Veneers shall be in accordance with the Architectural Woodwork Standards requirements for its use and the Grades.
- B. Panel Products: Comply with the Architectural Woodwork Standards and the following:
 - 1. General: Products with added urea formaldehyde shall be prohibited from the work.
 - 2. MDF: Medium Density Fiberboard
 - a. ANSI A208.2, Grade 2-MW.
 - b. No urea formaldehyde binders
 - 1). Manufacturer: Sierra Pine / Aerris, Medite II, Medex (moisture-resistant).
 - 3. Veneer Core Plywood (Hardwood Plywood): HPVA HP-1, Non-telegraphing hardwood manufactured with 1/16" thick laminations with zero or very few voids to ensure finish-grade edges.
 - a. Core species: Birch/Alder
 - b. Face species: As selected by the Architect.
 - c. Cut: Plain-sliced
 - d. No urea formaldehyde binders
 - e. Manufacturer: States Industries, Appleply.

2.2 PLASTIC LAMINATE

- A. Available Manufacturers: Subject to compliance with requirements, provide plastic laminate products from one of the following:
 - 1. Abet Laminati, Inc.
 - 2. Formica Corporation.
 - 3. Wilsonart International
- B. High-Pressure Decorative Laminate: NEMA LD 3.
 - 1. Plastic laminate shall meet the requirements of the Architectural Woodwork Standards for its intended use.
- C. Edgeband: High pressure decorative laminate.
- D. Adhesives:
 - 1. Type I, use Type II at wet locations.

2.3 SOLID-SURFACE COUNTERTOPS

- A. Solid Surface Material: Homogeneous solid sheets of filled plastic resin complying with ANSI SS1.
 - 1. Available Products:
 - a. Corian; DuPont Polymers.
 - b. Wilsonart Solid Surface; Wilsonart.
 - c. Acceptable equivalent.
 - 2. Color: As selected by the Architect.
- B. Counter top material shall be 1/2 inch thick with 1.5 inch visible edges, unless indicated otherwise.
 - 1. Back Splash-to-Wall Detail: Per Drawings.
 - a. Integral Sink Bowls: Where scheduled, comply with ISSFA-2 and ANSI Z124.3, Type 5 or Type 6, without a precoated finish.

2.4 PLASTIC LAMINATE COUNTERTOPS

- A. Plastic Laminate Manufacturer / Style, Color: Refer to Finish Schedule.
- B. Core Material:
 - 1. Exterior grade hardwood plywood with a non-telegraphing grain.
 - 2. Back Splash:
 - a. Wall mount, jobsite assembled.
 - 3. Back Splash-to-Wall Detail:
 - a. Butt joint.
 - 4. Front edges shall be self edge.

2.5 SOLID PHENOLIC COMPOSITE COUNTERTOPS

- A. Manufacturer / Product: Richlite / Paperstone.
 - 1. Back Splash-to-Wall Detail: Per drawings.
- B. Front Edge Exposed, 1.5 inch.
- C. Adhesives:
 - 1. Type I.
 - 2. Type II at wet locations.

2.6 MISCELLANEOUS MATERIALS

- A. Furring, Blocking, Shims, and Hanging Strips:
 - 1. Softwood or hardwood lumber, 2 inch x 6 inch nominal, kiln dried to less than 15

percent moisture content. Furnish fire-retardant treated softwood lumber where required. Refer to Section 061053 - MISCELLANEOUS ROUGH CARPENTRY.

2. Sheet Metal Backing: Minimum 16 gauge sheet x 6 inches. Refer to Section 092900 - GYPSUM BOARD.

B. Two-Part Methacrylate Adhesive:

1. Available Product: GW4300, as supplied by Glue Warehouse; www.gluewarehouse.com.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Verify the adequacy and proper location of any required backing or support framing.
- B. Verify that mechanical, electrical, plumbing, and other building components affecting work in this Section are in place and ready.

3.2 INSTALLATION

- A. Install all work in conformance with the Architectural Woodwork Standards, latest edition.
- B. Installation shall conform to the AWS Grade of the items being installed.
- C. All work shall be secured in place, square, plumb, and level.
- D. All work abutting other building components shall be properly scribed.
- E. Equipment cutouts shown on plans shall be cut by the installer.
- F. Form field joints in solid surface countertops using manufacturer's recommended adhesive, with joints inconspicuous in finished work.
- G. Exposed joints/seams shall not be allowed unless indicated on approved shop drawings. Reinforce field joints in solid surface countertops with solid surface strips extending a minimum of 1 inch on either side of the seam with the strip being the same thickness as the top.
- H. Cut and finish component edges with clean, sharp returns.
- I. Rout radii and contours to template.
- J. Anchor securely to supports.
- K. Align adjacent countertops and form seams to comply with manufacturer's written recommendations using adhesive in color to match countertop.
- L. Countertops:
 1. Install countertops with no more than 1/8-inch in 96 inches sag, bow or other

variation from a straight line.

2. Scribe and finish tops tightly to walls.
3. Backsplashes and applied sidesplashes: Furnish at locations with sinks only.
 - a. Install applied sidesplashes using manufacturer's standard color-matched silicone sealant. Adhere applied sidesplashes to countertops using manufacturer's standard color-matched silicone sealant.
 - b. Provide 4 inch high x 0.5 inch thick splashes where counter touches a wall, unless indicated otherwise.

3.3 ADJUSTING & TOUCH UP

- A. Before completion of the installation, the installer shall adjust all moving and operating parts to function smoothly and correctly.
- B. All nicks, chips, and scratches in the finish shall be filled and retouched. Damaged items that cannot be repaired shall be replaced.

3.4 CLEANUP

- A. Upon completion of installation, the installer shall clean all installed items of pencil and ink marks and broom clean the area of operation, depositing debris in containers provided by the Contractor.

3.5 PROTECTION

- A. Provide temporary protection to ensure Work being without damage or deterioration at time of final acceptance. Remove protections and re-clean as necessary immediately before final acceptance.

3.6 WASTE MANAGEMENT

- A. Separate and dispose of waste in accordance with the Project's Waste Management Plan.

END OF SECTION

SECTION 071326 - SELF-ADHERING SHEET WATERPROOFING

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Butyl-backed waterproofing sheet membrane.
 - 2. Molded sheet drainage panels.
- B. Related Documents and Sections: Examine Contract Documents for requirements that directly affect or are affected by Work of this Section. Other Documents and Sections that directly relate to work of this Section include, but are not limited to:
 - 1. General provisions of the Contract, including General and Supplementary Conditions, and Division 01 General Requirements Specification Sections.
 - 2. Section 033000 - CAST-IN-PLACE CONCRETE.
 - 3. Section 042000 - UNIT MASONRY.
 - 4. Section 072100 - BUILDING INSULATION.
 - 5. Section 072616 - UNDERSLAB VAPOR BARRIERS

1.2 SUBMITTALS

- A. Product Data: Include manufacturer's written instructions for evaluating, preparing, and treating substrate, technical data, and tested physical and performance properties of waterproofing.
- B. Shop Drawings: Show locations and extent of waterproofing. Include details for substrate joints and cracks, sheet flashings, penetrations, inside and outside corners, tie-ins with adjoining construction, and other termination conditions.
- C. Samples: For the following products:
 - 1. 8-by-8-inch square of waterproofing sheet.
 - 2. 6-by-6-inch square of drainage panel.
- D. Certification:
 - 1. Manufacturer: Submit written certification signed by manufacturer of each product that materials provided are suitable for long-term use with materials existing at site, including but not limited to soils containing saltwater and dredged hydraulic fills.
 - 2. Installer: Signed by manufacturers certifying that installers comply with requirements
- E. Product Test Reports: From a qualified independent testing agency indicating and interpreting test results of waterproofing for compliance with requirements, based on comprehensive testing of current waterproofing formulations.

- F. Sample Warranty: Copy of special waterproofing manufacturer's and Installer's warranty stating obligations, remedies, limitations, and exclusions before starting waterproofing.

1.3 QUALITY ASSURANCE

- A. Qualifications:
 - 1. Manufacturer: A firm experienced in producing specified materials similar to those indicated for this Project and with a record of successful in-service performance
 - 2. Installer: A firm approved or licensed by waterproofing manufacturer for installation of waterproofing required for this Project.
- B. Preinstallation Conference: Conduct conference at Project site. Review requirements for waterproofing, including surface preparation specified under other Sections, substrate condition and pretreatment, minimum curing period, forecasted weather conditions, special details and sheet flashings, installation procedures, testing and inspection procedures, and protection and repairs.
- C. Source Limitations: Obtain sheet waterproofing and associated materials through one source from a single manufacturer.
- D. Mockups: Build mockups to verify selections made under Sample submittals and to set quality standards for installation.
 - 1. Build for each typical waterproofing installation including accessories to demonstrate surface preparation, crack and joint treatment, corner treatment, and protection.
 - a. Size: As shown on Drawings.
 - b. Description: Each type of wall installation.
 - 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. Deliver materials to Project site in original packages with seals unbroken, labeled with manufacturer's name, product brand name and type, date of manufacture, and directions for storing and mixing with other components.
- B. Store liquid materials in their original undamaged packages in a clean, dry, protected location and within temperature range required by waterproofing manufacturer. Remove and replace liquid materials that cannot be applied within their stated shelf life.
- C. Store rolls according to manufacturer's written instructions. Protect stored materials from direct sunlight.

1.5 PROJECT CONDITIONS

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

1.6 WARRANTY

- A. Manufacturer's Warranty: Manufacturer's standard materials-only warranty in which manufacturer agrees to furnish replacement waterproofing material for waterproofing that does not comply with requirements or that fails to remain watertight within specified warranty period.
 - 1. Warranty Period: Ten (10) years from date of Substantial Completion.
- B. Installer's Special Warranty: Specified form, signed by Installer, covering Work of this Section.
 - 1. Warranty includes removing and reinstalling protection board and drainage panels,
 - 2. Warranty Period: Two years after date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MATERIALS, GENERAL

- A. Source Limitations for Waterproofing System: Obtain waterproofing materials and molded-sheet drainage panels from single source from single manufacturer.

2.2 SELF ADHERING SHEET WATERPROOFING

- A. Composite Sheet Waterproofing: Minimum 60-mil nominal thickness, self-adhering composite sheet consisting of 40 mils of HDPE special-weave saturated with a fluid LDPE laminated to a 20-mils of high-performance butyl, polyethylene-film reinforcement, and with release liner on adhesive side.
 - 1. Products: Subject to compliance with requirements, provide the following:
 - a. Basis of Design Product: Tremco, Inc., TREMproof 560
 - 2. Physical Properties:
 - a. Type: 20-mil high-performance butyl laminated to 40 mils of HDPE special-weave fabric
 - b. Color: Black
 - c. Solids: 100 %
 - d. Weight: 0.30 lbs. sq. ft. 60 mil and 0.22 lbs. per sq. foot 45 mil
 - e. Puncture Resistance: Exceeds 500 lb. (2224 N)

- f. Hydrostatic Resistance: 685 psi (4723 kPa)
- g. Application Temperature; Temperatures above 20°F (-6°C)

2.3 ACCESSORY MATERIALS

- A. General: Furnish accessory materials recommended by waterproofing manufacturer for intended use and compatible with sheet waterproofing.
- B. Joint Sealant: Elastomeric, single-component, silicone sealant, ASTM C 920 - Class 50, Type S, Grade NS, Use NT, M, A, O, G.
 - 1. Basis of Design Product: Tremco Inc., Spectrem 1
- C. Joint Sealant: Elastomeric, single-component, silicone sealant, ASTM C 920 – Class 50, Type S, Grade NS, USE T, NT, M, A, O, I
 - 1. Basis of Design Product: Tremco Inc., Dymonic 100
- D. Termination Mastic: Air barrier manufacturer's standard cold fluid-applied elastomeric liquid; trowel grade, with recommended glass-fiber mesh tape.
 - 1. Basis of Design Product: Tremco, Inc., ExoAir Termination Mastic

2.4 MOLDED-SHEET DRAINAGE PANELS

- A. Nonwoven-Geotextile-Faced, Molded-Sheet Drainage Panel: Composite subsurface drainage panel consisting of a studded, non-biodegradable, molded-plastic-sheet drainage core; with a nonwoven, needle-punched geotextile facing with an apparent opening size not exceeding No. 70 (0.21-mm) sieve laminated to one side of the core; and with a vertical flow rate of 9 to 15 gpm per ft. (112 to 188 L/min. per m).
 - 1. Products: Subject to compliance with requirements, provide the following:
 - a. Basis of Design Product: Tremco, Inc., TREMDrain 1000

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements and other conditions affecting performance of the waterproofing.
- B. Verify that substrate is within the moisture limits recommended in writing by manufacturer.
- C. Verify that compacted subgrade is smooth, sound and ready to receive waterproofing sheet.
- D. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 SURFACE PREPARATION

- A. Clean, prepare, and treat substrates according to manufacturer's written instructions. Provide clean, dust-free, and dry substrates for waterproofing application.
- B. Remove grease, oil, bitumen, form-release agents, paints, curing compounds, and other penetrating contaminants or film-forming coatings from concrete.
- C. Remove fins, ridges, mortar, and other projections and fill honeycomb, aggregate pockets, holes, and other voids.
- D. Prepare, fill, prime, and treat joints and cracks in substrates. Remove dust and dirt from joints and cracks according to ASTM D 4258.
- E. Corners: Prepare and treat inside inside corners in accordance with manufacturer's written instructions.
- F. Prepare, treat, and seal vertical and horizontal surfaces at terminations and penetrations through waterproofing and at drains and protrusions according to ASTM D 6135.

3.3 SELF-ADHERED SHEET WATERPROOFING APPLICATION

- A. Install self-adhered sheet according to waterproofing manufacturer's written instructions.
- B. Apply and firmly adhere sheets over area to receive waterproofing. Accurately align sheets and maintain uniform 2 inch (51 mm) minimum lap widths and end laps. Overlap and seal seams, and stagger end laps to ensure watertight installation.
- C. Apply continuous sheets over already-installed sheet strips, bridging substrate cracks, construction, and contraction joints.
- D. Seal edges of sheet-waterproofing terminations with termination mastic.
- E. Install sheet-waterproofing and auxiliary materials to tie into adjacent waterproofing.
- F. Repair tears, voids, and lapped seams in waterproofing not complying with requirements. Slit and flatten fishmouths and blisters. Patch with sheet waterproofing extending 6 inches (150 mm) beyond repaired areas in all directions.
- G. Immediately install molded sheet drainage panels.

3.4 FIELD QUALITY CONTROL

- A. Owner will engage a site representative qualified by waterproofing membrane manufacturer to inspect substrate conditions, surface preparation, membrane application, flashings, protection, and drainage components, and to furnish daily reports to Architect.
- B. Prepare test and inspection reports.

3.5 PROTECTION, REPAIR, AND CLEANING

- A. Protect waterproofing from damage and wear during remainder of construction period.
- B. Protect installed waterproofing system from damage due to UV light, harmful weather exposures, physical abuse, and other causes. Provide temporary coverings where insulation is subject to abuse and cannot be concealed and protected by permanent construction immediately after installation.
- C. Correct deficiencies in or remove waterproofing that does not comply with requirements; repair substrates, reapply waterproofing, and repair sheet flashings.
- D. Clean spillage and soiling from adjacent construction using cleaning agents and procedures recommended by manufacturer of affected construction.

END OF SECTION

SECTION 071616 - CRYSTALLINE WATERPROOFING

PART 1 - GENERAL

1.1 SUMMARY

- A. Section includes:
 - 1. Crystalline waterproofing for entire interior of sump pits and elevator pit.
- B. Related Documents and Sections: Examine Contract Documents for requirements that directly affect or are affected by Work of this Section. Other Documents and Sections that directly relate to work of this Section include, but are not limited to:
 - 1. General provisions of the Contract, including General and Supplementary Conditions, and Division 01 General Requirements Specification Sections.
 - 2. Section 033000 - CAST-IN-PLACE CONCRETE.
 - 3. Section 071326 - SELF-ADHERING SHEET WATERPROOFING.
 - 4. Section 079200 - JOINT SEALANTS.

1.2 SYSTEM DESCRIPTION

- A. Crystalline Waterproofing: Cementitious waterproofing material, self-curing, with a very high resistance to the penetration of chloride ions.

1.3 SUBMITTALS

- A. Product Data: For each type of product indicated. Include construction details, material descriptions and installation instructions for crystalline waterproofing.
- B. Qualification Data: For Applicator.
- C. Product Certificates: For waterproofing, patching and plugging materials, from manufacturer.
- D. Product Test Reports: Based on evaluation of comprehensive tests performed by manufacturer and witnessed by a qualified testing agency, for crystalline waterproofing.
- E. Field Quality Control Reports.

1.4 QUALITY ASSURANCE

- A. Applicator Qualifications: A firm experienced in applying crystalline waterproofing similar in material, design, and extent to that indicated for this Project, whose work has resulted in applications with a record of successful in-service performance.
- B. Preinstallation Conference: Conduct conference at Project site.

1.5 PROJECT CONDITIONS

- A. Weather Limitations: Proceed with application only when existing and forecasted weather conditions permit crystalline waterproofing to be performed according to manufacturer's written instructions.
- B. Proceed with waterproofing work only after pipe sleeves, vents, curbs, inserts, drains and other projections through the substrate to be waterproofed have been completed. Proceed only after substrate defects, including honeycombs, voids and cracks, have been repaired to provide a sound substrate free of forming materials, including reveal inserts.
- C. Ambient Conditions: Proceed with waterproofing work only if temperature is maintained at 40 deg F or above during work and cure period, and space is well ventilated and kept free of water.

PART 2 - PRODUCTS

2.1 WATERPROOFING MATERIALS

- A. Crystalline Waterproofing: Prepackaged, proprietary blend of portland cement, specially treated sand, and active chemicals that, when mixed with water and applied, penetrates into concrete and concrete unit masonry and reacts chemically with the byproducts of cement hydration in the presence of water to develop crystalline growth within substrate capillaries to produce an impervious, dense, waterproof substrate; that has VOC content complying with limits of authorities having jurisdiction; with properties meeting or exceeding the criteria specified below.
 - 1. Water Permeability: Maximum zero for water at 30 feet when tested according to CE CRD-C 48.
 - 2. Compressive Strength: Minimum 4000 psi at 28 days when tested according to ASTM C 109/C 109M.

2.2 ACCESSORY MATERIALS

- A. Patching Compound: Factory-premixed cementitious repair mortar, crack filler, or sealant recommended by waterproofing manufacturer for filling and patching tie holes, honeycombs, reveals, and other imperfections; compatible with substrate and other materials indicated; and VOC content complying with limits of authorities having jurisdiction.
- B. Plugging Compound: Factory-premixed cementitious compound with hydrophobic properties and recommended by waterproofing manufacturer; resistant to water and moisture but vapor permeable for all standard applications (vertical, overhead, and horizontal surfaces not exposed to vehicular traffic); compatible with substrate and other materials indicated; and VOC content complying with limits of authorities having jurisdiction.
- C. Portland Cement: ASTM C 150, Type I.

- D. Sand: ASTM C 144.
- E. Polymer Admixture for Protective Topping: Polymer bonding agent and admixture designed to improve adhesion to prepared substrates and not to create a vapor barrier.
- F. Water: Potable.

2.3 MIXES

- A. Crystalline Waterproofing: Add prepackaged dry ingredients to water according to manufacturer's written instructions. Mix together with mechanical mixer or by hand to required consistency.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates, areas, and conditions, with Applicator present, for suitable conditions where waterproofing is to be applied.
- B. Proceed with application only after unsatisfactory conditions have been corrected.
- C. Notify Architect in writing of active leaks or defects that would affect system performance.

3.2 PREPARATION

- A. Protect other work from damage caused by cleaning, preparation, and application of waterproofing. Provide temporary enclosure to ensure adequate ambient temperatures and ventilation conditions for application.
- B. Do not allow waterproofing, patching, and plugging materials to enter reveals or annular spaces intended for resilient sealants or gaskets, such as joint spaces between pipes and pipe sleeves.
- C. Stop active water leaks with plugging compound according to waterproofing manufacturer's written instructions.
- D. Repair damaged or unsatisfactory substrate with patching compound according to manufacturer's written instructions.
 - 1. At holes and cracks in substrate, remove loosened chips and cut reveal with sides perpendicular to surface, not tapered, and approximately 1 inch (25.4 mm) deep. Fill reveal with patching compound flush with surface.
- E. Surface Preparation: Comply with waterproofing manufacturer's written instructions to remove efflorescence, chalk, dust, dirt, mortar spatter, grease, oils, paint, curing compounds and form-release agents to ensure that waterproofing bonds to surfaces.
 - 1. Clean concrete surfaces according to ASTM D 4258.

- a. Scratch- and Float-Finished Concrete: Etch with 10 percent muriatic (hydrochloric) acid solution according to ASTM D 4260.
 - b. Prepare smooth-formed and trowel-finished concrete by mechanical abrading or abrasive-blast cleaning according to ASTM D 4259.
2. Concrete Joints: Clean reveals according to waterproofing manufacturer's written instructions.

3.3 APPLICATION

- A. General: Comply with waterproofing manufacturer's written instructions for application and curing.
 1. Saturate surface with water for several hours prior to application and maintain damp condition until applying waterproofing. Remove standing water.
 2. Apply waterproofing to surfaces indicated on Drawings.
 3. Number of Coats: Number required for specified water permeability.
 4. Application Method: Apply to ensure that each coat fills voids and is in full contact with substrate or previous coat.
 5. Dampen surface between coats.
- B. Curing: Moist-cure waterproofing for three days immediately after final coat has set, followed by air drying, unless otherwise recommended in writing by manufacturer.

3.4 FIELD QUALITY CONTROL

- A. Inspection: Engage manufacturer's representative to inspect completed application and provide a written report that application complies with manufacturer's written instructions.

3.5 WASTE MANAGEMENT

- A. Separate and dispose of waste in accordance with the Project's Waste Management Plan.

END OF SECTION

SECTION 072100 - BUILDING INSULATION

PART 1 - GENERAL

1.1 SUMMARY

- A. Provide building insulation work as indicated on Drawings, and as specified, including but not limited to:
 - 1. Mineral wool insulation.
 - 2. Rigid insulation.
 - 3. Other building insulation work as may be called for on Drawings and not indicated or specified to be included under other Sections.
- B. Scope:
 - 1. Insulation under slabs-on-grade.
 - 2. Insulation at curtain wall spandrels.
 - 3. Foundation wall insulation.
 - 4. Cavity wall insulation within masonry cavity.
- C. Related Documents and Sections: Examine Contract Documents for requirements that directly affect or are affected by Work of this Section. Other Documents and Sections that directly relate to work of this Section include, but are not limited to:
 - 1. General provisions of the Contract, including General and Supplementary Conditions, and Division 01 General Requirements Specification Sections.
 - 2. Section 042000 - UNIT MASONRY.
 - 3. Section 075423 - THERMOPLASTIC POLYOLEFIN ROOFING
 - 4. Section 084000 - ALUMINUM-FRAMED FACADE SYSTEMS.
 - 5. Section 092900 - GYPSUM BOARD.

1.2 SYSTEM DESCRIPTION

- A. Design Criteria:
 - 1. Insulation is to be a contiguous envelope on all six sides and sealed air and water-tight around each fenestration.
 - 2. Vapor retarders, when specified, are to be provided as one contiguous monolithic sealed enclosure, and sealed tight around fenestrations and penetrations.
- B. Performance Criteria:
 - 1. Insulation type and minimum thickness for walls, roofs, and floors at grade and cantilevered over open space: Refer to Drawings.
 - 2. General Requirements: Wall above grade, metal framed: Minimum R13 and R7.5

continuous

C. Basis of Design Insulation Systems:

1. INS-02 Exterior Wall at Storefront Shadow Box: Rockwool CurtainRock 2" Semi-Rigid stone wool insulation
2. INS-03 Foundation Wall: DOW High Load Extruded Polystyrene Insulation 100 psi 2" board
3. INS-04 Exterior Wall Cavity: Rockwool CavityRock semi-rigid exterior cavity wall stone wool insulation
4. INS-05 Exterior Wall between Framing: Rockwool Comfortbatt semi-rigid stone wool batt insulation 6" @ R-24

1.3 SUBMITTALS

A. Action Submittals:

1. Product Data: Submit manufacturer's printed descriptions of materials and systems, performance criteria, use limitations, recommendations and installation information.
 - a. Each product, including but not limited to insulation, adhesive, tape, vapor retarder, film.
 - b. VOC data for each product.
 - c. R-Value of each insulation type per inch, aged (LTTR).

B. Informational Submittals:

1. Quality Assurance Submittals:
 - a. Test Reports:
 - b. Certificates:
 - 1). Certify R-value or U-value including aged LTTR.
 - 2). Certify that firesafing materials used are fireproof, inorganic and free of carcinogenic mineral fibers or toxic substances.
 - c. Manufacturer's Installation Instructions:
 - d. Qualification Statements:

1.4 QUALITY ASSURANCE

A. Qualifications:

1. Manufacturer: Company specializing in manufacturing the products specified in this section with minimum five (5) years documented experience.
 - a. Licensed by manufacturer of proprietary formulations.
2. Applicator: Company specializing in performing the work of this section with minimum three (3) years documented experience.
 - a. Certified by the manufacturer.

B. Regulatory Requirements:

1. Surface-Burning Characteristics: ASTM E84.
 2. Classes for flame spread index are I (FSI of 0 to 25), II (FSI of 26 to 75), and III (FSI of 76 to 200). Some codes use A, B, and C instead of I, II, and III.
 3. Fire-Resistance Ratings: ASTM E119.
 4. Combustion Characteristics: ASTM E136.
- C. Source Limitations: Obtain each type of insulation and related accessories through one source from a single manufacturer.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Materials shall be delivered to site in original, unopened packages or containers bearing manufacturer's names, brand names, and types and thicknesses of contents.
- B. Store off floor in interior spaces, adequately protected against damage from all sources.

PART 2 - PRODUCTS

2.1 MINERAL WOOL INSULATION

- A. Mineral-Wool Board, Faced (INS-02): ASTM C612, Type IVA; faced on one side with foil-scrim or foil-scrim-polyethylene vapor retarder; with maximum flame-spread and smoke-developed indexes of 15 and zero, respectively, per ASTM E84. Nominal density of 3.5 lb/cu. ft..
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Basis-of-Design: Rockwool International; CURTAINROCK.
 - b. Johns Manville; a Berkshire Hathaway company.
 - c. Thermafiber, Inc.; an Owens Corning company.
- B. Mineral-Wool Board, Unfaced (INS-04): ASTM C612, Type IVB; with maximum flame-spread and smoke-developed indexes of 15 and zero, respectively, per ASTM E84; passing ASTM E136 for combustion characteristics. Nominal density of 6 lb/cu. ft. (96 kg/cu. m).
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Basis-of-Design: Rockwool International; CAVITYROCK.
 - b. Johns Manville; a Berkshire Hathaway company.
 - c. Thermafiber, Inc.; an Owens Corning company.
- C. Mineral Wool or Slag Wool Fiber or Rock Wool Fiber Blanket Insulation (INS-05): Unfaced, Slag-Wool-Fiber / Rock Wool Fiber Blanket Insulation: ASTM C665, Type I (blankets without membrane facing); consisting of consisting of fibers; thickness as indicated with width and length as required to suit job conditions; surface burning characteristics per ASTM E136: Class A.

1. Manufacturers. Subject to requirements select products from the following:
 - a. Basis-of-Design: Rockwool COMFORTBATT.
 - b. Fibrex Insulations Inc.
 - c. Owens Corning.
 - d. Thermafiber.

2.2 FOAM PLASTIC BOARD INSULATION (INS-03)

- 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. DiversiFoam Products.
 2. Dow Chemical Company (The).
 3. Owens Corning.
 4. Pactiv Building Products.
 5. InsulFoam.
 6. Architect acceptable equivalent:
- B. Product Requirements:
 1. Flame-Spread And Smoke-Developed Indexes (ASTM E84): 75 and 450 maximum.
 2. R-Value (ASTM C518, at 75 deg F):
 - a. XPS: Minimum 5.0
 - b. EPS: Minimum 3.6
- C. Extruded-Polystyrene Board Insulation: ASTM C578, of type and minimum compressive strength required for installed loading.

2.3 AUXILIARY INSULATING MATERIALS

- A. Spray Foam Insulation for Miscellaneous Air Sealing: Non-expanding and expanding polyurethane spray foam.
 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. Pur Fill
 - b. Hilti
 - c. Touch-N-Foam
 - d. Architect acceptable equivalent.
- B. Adhesive for Bonding Insulation: Product recommended by insulation manufacturer with demonstrated capability to bond insulation securely to substrates indicated without damaging insulation and substrates.

2.4 INSULATION FASTENERS

- A. Adhesively Attached, Spindle-Type Anchors: Plate welded to projecting spindle; capable of holding insulation of thickness indicated securely in position indicated with self-locking washer in place; and complying with the following requirements:
 - 1. Plate: Perforated galvanized carbon-steel sheet, 0.030 inch thick by 2 inches square.
 - 2. Spindle: Copper-coated, low carbon steel; fully annealed; 0.105 inch in diameter; length to suit depth of insulation indicated.
- B. Adhesively Attached, Angle-Shaped, Spindle-Type Anchors: Angle welded to projecting spindle; capable of holding insulation of thickness indicated securely in position indicated with self-locking washer in place; and complying with the following requirements:
 - 1. Angle: Formed from 0.030 inch thick, perforated, galvanized carbon-steel sheet with each leg 2 inches square.
 - 2. Spindle: Copper-coated, low carbon steel; fully annealed; 0.105 inch in diameter; length to suit depth of insulation indicated.
- C. Insulation-Retaining Washers: Self-locking washers formed from 0.016 inch thick galvanized steel sheet, with beveled edge for increased stiffness, sized as required to hold insulation securely in place, but not less than 1-1/2 inches square or in diameter.
 - 1. Capped self-locking washers incorporating a spring steel insert to ensure permanent retention of cap.
- D. Anchor Adhesive: Product with demonstrated capability to bond insulation anchors securely to substrates indicated without damaging insulation, fasteners, and substrates.
- E. Staples or Nails: ASTM F1667, zinc coated, size and type best suited for purpose.
- F. Screws: ASTM C954 or C1002, size and length best suited for purpose with washer not less than 2 inches in diameter.
- G. Impaling Pins: Steel pins with head not less than 2 inches in diameter with adhesive for anchorage to substrate. Provide impaling pins of length to extend beyond insulation and retain cap washer when washer is placed on the pin.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Carefully examine areas with Installer present, for compliance with requirements affecting Work performance.
 - 1. Verification of Conditions: Verify that field measurements, surfaces, substrates, structural support, utility connections, tolerances, humidity, cleanliness and other conditions are as required, and ready to receive Work.
 - a. Test substrate as required by manufacturer to verify proper conditions.

2. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Comply with manufacturer's written installation instructions for preparing substrates.
 1. Protect adjacent surfaces from damage due to insulation installation.
 2. Protect adjacent surfaces from damage due to spray or foam insulation installation.

3.3 INSTALLATION – GENERAL

- A. Install insulation in accordance with manufacturer's written application instructions, and as specified.
- B. Install insulation as a contiguous envelope on all sides, including roofs, exterior walls and at grade; tight around each fenestration:
 1. Secure insulation in place to prevent shifting and discontinuity of the insulation envelope:
 2. Allow for material and building movement:
 3. Fit insulation tight against adjoining construction, penetrations and tight to fenestration frames, unless noted otherwise:
 4. Fill voids around penetrations and fenestrations with insulation:
 5. Insulation thickness as called out by the Drawings:
- C. Install rigid insulating units with joints close and flush, in regular courses and with cross-joints overlapping:
 1. Align and space rigid insulation joints with building movement joints:
 2. Seal perimeter and around penetrations with compatible materials as recommended by manufacturer.
 3. At horizontal rigid foam installations, install coverboard to protect insulation from foot traffic.
- D. Install batt or blanket insulation with tight joints and filling framing void completely. Seal cuts, tears, and unlapped joints with tape:
- E. Vapor Diffusion Retarders: Provide one contiguous monolithic sealed enclosure, including roofs, exterior walls and at grade; sealed tight around each fenestration:
 1. Install vapor barrier facing heated (warm and moist) side, unless noted otherwise:
 2. Allow for material and building movement:
- F. Do not close-up or foam pipe or other chases until inspection reviews by authorities having jurisdiction and the Architect have been approved:

3.4 CLEANING AND PROTECTION

- A. At end of each workday, remove rubbish other discarded materials from Project site.

- B. Protect the work of other trades and work of this Section already installed against soiling and damage by the exercise of reasonable care and precautions. Repair or replace any work so damaged or soiled.
- C. At completion of construction activities of other trades, touch up and restore damaged or defaced coated surfaces.

3.5 WASTE MANAGEMENT

- A. Separate and dispose of waste in accordance with the Project's Waste Management Plan.

END OF SECTION

SECTION 072616 - UNDERSLAB VAPOR BARRIERS

PART 1 - GENERAL

1.1 SUMMARY

1. Work of this Section consists of underslab vapor barriers.
- B. Related Documents and Sections: Examine Contract Documents for requirements that directly affect or are affected by Work of this Section. Other Documents and Sections that directly relate to work of this Section include, but are not limited to:
 1. General provisions of the Contract, including General and Supplementary Conditions, and Division 01 General Requirements Specification Sections.
 2. Section 033000 - CAST-IN-PLACE CONCRETE.

1.2 SUBMITTALS

- A. Product Data: Submit manufacturer's printed descriptions of materials and systems, performance criteria, use limitations, recommendations and installation information.
- B. Samples
 1. Submit a sample piece of each sheet product a minimum 12 by 12 inches.
- C. Quality Assurance Submittals
 1. Test Reports: Certify that actual material, which will be shipped to site is the material which has been tested to meet requirements of ASTM C1709, Method B.
 2. Certificates: Submit with manufacturer's signature certifying that product and/or system meets the requirements of the performance characteristics, physical criteria, and applicable standards specified.
 3. Manufacturer's Instructions: Installation.
 4. Qualification Statements: Submit a letter, on printed letterhead and signed by an officer of the firm, for each listed quality assurance qualification listed, attesting to meeting each requirement called out.

1.3 QUALITY ASSURANCE

- A. Qualifications:
 1. Manufacturer Qualifications: A firm experienced a minimum five (5) years in manufacturing products or systems similar to those indicated for this Project and with a record of successful in-service performance.
 2. Installer Qualifications: Perform installation with skilled, experienced and trained workmen supervised by trained personnel who shall have at least three (3) years successful experience in installations of similar size and scope.

- B. Source Limitations: Obtain underslab vapor barrier materials through one source from a single manufacturer.

1.4 DELIVERY, STORAGE, AND HANDLING

- A. Shipping, Delivery and Handling: Adequately protect products from soiling, damage, deterioration, and loss, including theft.
 - 1. Deliver materials to Project site in an undamaged condition, in original, unopened and undamaged packages or bundles bearing manufacturer's intact label, names, brand names, types and thicknesses of contents, and proper handling, storing, unpacking, protecting, and installation instructions, as warranted.
 - 2. In addition to the above requirements, follow manufacturer's recommendation for shipping, delivery and handling.

PART 2 - PRODUCTS

2.1 UNDERSLAB VAPOR BARRIER

- A. Basis-of-Design Manufacturer / Products: Provide Stego Wrap by Stego Industries, or acceptable equivalent by one of the following:
 - 1. W.R. Meadows.; Perminator 15 mil.
 - 2. Insulation Solutions Inc.; Viper II.
- B. Product Description: 15-mil polyolefin manufactured from ISO certified virgin resins.
 - 1. Reference Standard: ASTM E1745 Class A (premium);
 - 2. Puncture Resistance: 2445 grams, ASTM D1709.
 - 3. Water Vapor Permeance: less than 0.012 perms (premium), ASTM E96 & F1249.
 - 4. Tensile Strength: 76.6 lbf/in., ASTM D882
- C. Vapor-Retarding Mastic: Manufacturer's proprietary mastic that can be used as an alternate to boots for pipe penetrations in vapor barrier. Mastic shall also be approved for use as a primary waterproofing for below grade walls.
 - 1. Composition: A medium-viscosity, water-based, polymer-modified anionic bituminous / asphalt emulsion, which exhibits bonding, elongation and waterproofing characteristics.
 - a. Available Product: Stego Industries / Stego Mastic.
- D. Vapor-Retarder Tape: Pressure-sensitive tape with adhesive on one face; of type recommended by vapor-retarder manufacturer for sealing joints and penetrations in vapor retarder.
- E. Pre-formed Pipe Boots: As supplied by vapor retarded manufacturer.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Carefully examine installation areas with Installer present, for compliance with requirements affecting Work performance.
 - 1. Verification of Conditions: Verify that surfaces, substrates, cleanliness and other conditions are as required by the manufacturer, and ready to receive Work.
 - 2. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Substrate Preparation in accordance with manufacturer's instructions.
 - 1. Prepare surfaces to receive air barrier membrane in accordance with manufacturer's instructions.
 - a. Do not apply membrane to surfaces unacceptable to manufacturer.

3.3 INSTALLATION

- A. Install in strict accordance with manufacturer's written instructions.
- B. Coordinate with work of other Sections so as to avoid delay and prevent unnecessary exposure and damage to underslab vapor barrier.
- C. Detailing:
 - 1. For small pipe and rebar penetrations in vapor barrier cut sheet just big enough for the penetration. Liberally apply mastic around the penetration to keep the integrity of the membrane intact. Mastic can be applied by brush, roller, or sprayer.
 - a. For larger penetrations or wide cut-outs of sheet vapor barrier, use sheet vapor barrier and polyethylene seam tape to repair and seal.
 - b. Solvent-based products should not be applied over this product.
- D. Coordinate with work of other Sections so as to avoid delay and prevent unnecessary exposure and damage to underslab vapor retarder.
- E. Install contiguously sealed.
 - 1. Provide manufacturers preformed penetration boots and other components to assure positive seals at penetrations.

3.4 CLEANING AND PROTECTION

- A. Protect vapor barrier system from damage during application and remainder of construction period, according to manufacturer's written instructions.
- B. Protect vapor barrier from exposure to UV light and harmful weather exposure beyond

manufacturer's recommendations. Remove and replace air barrier exposed for more than manufacturer's recommended maximum time limit.

3.5 WASTE MANAGEMENT

- A. Separate and dispose of waste in accordance with the Project's Waste Management Plan.

END OF SECTION

SECTION 072727 - SELF ADHERED SHEET MEMBRANE AIR BARRIERS

PART 1 - GENERAL

1.1 SUMMARY

- A. Section includes:
 - 1. Materials and installation methods for self-adhered vapor permeable air barrier membrane system.
 - 2. Materials and installation methods to bridge and seal air leakage pathways in roof and foundation junctions, window and door openings, control and expansion joints, adjacent existing conditions, piping and other penetrations through the wall assembly.
- B. Related Documents and Sections: Examine Contract Documents for requirements that directly affect or are affected by Work of this Section. A list of those Documents and Sections includes, but is not limited to the following:
 - 1. Drawings and general provisions of the Contract, including General and Supplementary Conditions and General Requirements, and Division 01 Specification Sections.
 - 2. Section 061600 - SHEATHING.
 - 3. Section 072100 - THERMAL INSULATION.

1.2 SUBMITTALS

- A. Qualification Data: For Installer. Include list of ABAA-certified installers and supervisors employed by the Installer, who work on Project.
- B. Product Certificates: From air-barrier manufacturer, certifying compatibility of air barriers and accessory materials with Project materials that connect to or that come in contact with air barrier.
- C. Product Test Reports: Based on evaluation of comprehensive tests performed by a qualified testing agency, for air barriers, submit certified test report showing compliance with requirements specified for ASTM E2178.
- D. Samples: Submit clearly labeled samples, 3 by 4 inch (75 mm by 100 mm) minimum size of each material specified.
- E. Compatibility: Submit letter from manufacturer stating that materials proposed for use are permanently chemically compatible and adhesively compatible with adjacent materials proposed for use. Submit letter from manufacturer stating that cleaning materials used during installation are chemically compatible with adjacent materials proposed for use.

1.3 QUALITY ASSURANCE

- A. Installer Qualifications: An entity that employs installers and supervisors who are trained and approved by manufacturer. The work of this section shall be performed by a company which specializes in the type sheet-applied membrane air barriers work required for this Project, with a minimum of 15 years of documented successful experience and shall be performed by skilled workmen thoroughly experienced in the necessary crafts
 - 1. Installer shall be licensed by ABAA according to ABAA's Quality Assurance Program and shall employ ABAA-certified installers and supervisors on Project.
- B. Mockups: Build mockups to set quality standards for materials and execution.
 - 1. Build integrated mockups of exterior wall assembly as shown on Drawings incorporating backup wall construction, external cladding, window, storefront, door frame and sill, insulation, ties and other penetrations, and flashing to demonstrate surface preparation, crack and joint treatment, application of air barriers, and sealing of gaps, terminations, and penetrations of air-barrier assembly.
 - a. Coordinate construction of mockups to permit inspection by Owner's testing agency of air barrier before external insulation and cladding are installed.
 - b. Include junction with roofing membrane, building corner condition, and existing adjacent conditions.
 - c. If Architect determines mockups do not comply with requirements, reconstruct mockups and apply air barrier until mockups are approved.
 - 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. Remove and replace liquid materials that cannot be applied within their stated shelf life.
- B. Protect stored materials from direct sunlight.

1.5 FIELD CONDITIONS

- A. Environmental Limitations: Apply air barrier within the range of ambient and substrate temperatures recommended by air-barrier manufacturer.
 - 1. Protect substrates from environmental conditions that affect air-barrier performance.
 - 2. Do not apply air barrier to a damp or wet substrate or during snow, rain, fog, or mist.
- B. Temperature: Provide air barrier recommended by air barrier manufacturer suitable for service in the range of ambient and surface temperatures that can occur at the project site.

1.6 WARRANTY

- A. Submit manufacturer's warranty that air barrier and accessories are free of defects at time of delivery and are manufactured to meet manufacturer's published physical properties and material specifications.
 - 1. Warranty Period: Ten years from date of completion of the air barrier membrane installation.
- B. Installer's Warranty:
 - 1. Provide a warranty for materials and workmanship of the Contract from Date of Completion for a period of 5 (Five) years (the "warranty period"). Provide all manufacturer's pass through warranties. Also provide a warranty to cover all the costs of materials, labor and equipment to remove any defective components.
 - 2. This warranty shall also cover the costs associated with removing and replacing external cladding so that remedial works can be carried out. The content of each warranty is to be approved by the Architect.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. General: Air barrier shall be capable of performing as a continuous air barrier and as a liquid-water drainage plane flashed to discharge to the exterior incidental condensation or water penetration. Air-barrier assemblies shall be capable of accommodating substrate movement and of sealing substrate expansion and control joints, construction material changes, penetrations, tie-ins to installed waterproofing, and transitions at perimeter conditions without deterioration and air leakage exceeding specified limits.
- B. Air-Barrier Assembly Air Leakage: Maximum 0.04 cfm/sq. ft. of surface area at 1.57 lbf/sq. ft. (0.2 L/s x sq. m of surface area at 75 Pa) when tested according to ASTM E 283 ASTM E 2357.
- C. Connections to Adjacent Materials: Provide connections to prevent air and water leakage and vapor migration at the following locations:
 - 1. Foundation and walls, including penetrations, ties and anchors.
 - 2. Walls, windows, curtain walls, storefronts, louvers or doors.
 - 3. Different wall assemblies and fixed openings within those assemblies.
 - 4. Wall and roof connections.
 - 5. Floors over unconditioned space.
 - 6. Walls, floor and roof across construction, control and expansion joints.
 - 7. Walls, floors and roof to utility, pipe and duct penetrations.
 - 8. Seismic and expansion joints.
 - 9. All other leakage pathways in the building envelope.
- D. Air Barrier Assembly Water Infiltration: Provide air barrier systems that do not evidence water leakage at a pressure difference of 15 psf when tested according to ASTM E331.

1. Definition of Uncontrolled Water Penetration and Test Specimen Failure shall be as published by ASTM with the following additions:
 - a. There shall be no water penetration inboard of the air barrier plane and the assembly shall provide rapid drainage resulting in no retained water in cavities outboard of the air barrier. There shall be no uncontrolled water infiltrating system or migration of water into the concealed spaces of any exterior wall cavity not intended to function as a "wet zone" in the design of the above-grade building envelope. Water controlled by flashing and gutters that is drained back to the exterior and cannot damage adjacent materials and finishes is not considered water leakage.
 - b. Air barrier systems shall be designed, fabricated and installed with the necessary provisions required to drain accumulated rainwater or condensation inside the system to the building exterior. Provide accessories required to complete the concealed drainage system including but not limited to flashings, weeps seals, dams, tubes, sealants and diverters. Provide baffles as required to prevent the ingress of wind driven water.

2.2 MATERIALS, GENERAL

- A. Source Limitations: Obtain primary air-barrier materials and air-barrier accessories from single source from single manufacturer.

2.3 SELF-ADHERED SHEET MEMBRANE AIR BARRIER

- A. Self-adhered membrane consisting of a breathable carrier film with a specially designed adhesive, which permits the transfusion of water vapor and provides superior protection against the damaging effects of air and water ingress on building structures, Product shall have the following minimum physical properties
 1. Products: Subject to compliance with requirements, provide one of the following:
 - a. Grace, W. R., & Co.; Perm-A-Barrier VPS
 - b. Henry Company; Blueskin VP 160
 - c. Carlisle CCW; Fire Resist 705 VP
 2. Physical and Performance Properties:
 - a. Air Permeance: Maximum 0.004 cfm/sq. ft. of surface area at 1.57-lbf/sq. ft. (0.02 L/s x sq. m of surface area at 75-Pa) pressure difference; ASTM E 2178.
 - b. Vapor Permeance: Minimum 10 perm; ASTM E 96
 - c. Fire Propagation Characteristics: Passes NFPA 285 testing as part of an approved assembly.

2.4 ACCESSORY MATERIALS

- A. General: Accessory materials recommended by air-barrier manufacturer to produce a complete air-barrier assembly and compatible with primary air-barrier membrane.
- B. Primer: Liquid waterborne primer recommended for substrate by air-barrier material manufacturer.

- C. Counterflashing Strip: Modified bituminous 40-mil- (1.0-mm-) thick, self-adhering sheet consisting of 32 mils (0.8 mm) of rubberized asphalt laminated to an 8-mil- (0.2-mm-) thick, cross-laminated polyethylene film with release liner backing.
- D. Butyl Strip: Vapor retarding, 30 to 40 mils (0.76 to 1.0 mm) thick, self-adhering; polyethylene-film-reinforced top surface laminated to layer of butyl adhesive, with release liner backing.
- E. Modified Bituminous Strip: Vapor retarding, 40 mils (1.0 mm) thick, smooth surfaced, self-adhering; consisting of 36 mils (0.9 mm) of rubberized asphalt laminated to a 4-mil- (0.1-mm-) thick, cross-laminated polyethylene film with release liner backing.
- F. Termination Mastic: Air-barrier manufacturer's standard cold fluid-applied elastomeric liquid; trowel grade.
- G. Substrate-Patching Membrane: Manufacturer's standard trowel-grade substrate filler.
- H. Adhesive and Tape: Air-barrier manufacturer's standard adhesive and pressure-sensitive adhesive tape.
- I. Stainless-Steel Sheet: ASTM A 240/A 240M, Type 316, 0.040-inch thick, and Series 300 stainless-steel fasteners.
- J. Modified Bituminous Transition Strip: Vapor retarding, 40 mils (1.0 mm) thick, smooth surfaced, self-adhering; consisting of 36 mils (0.9 mm) of rubberized asphalt laminated to a 4-mil- (0.1-mm-) thick polyethylene film with release liner backing.
- K. Elastomeric Flashing Sheet: ASTM D 2000, minimum 50- to 65-mil- (1.3- to 1.6-mm-) thick, cured sheet neoprene with manufacturer-recommended contact adhesives and lap sealant with stainless-steel termination bars and fasteners
- L. Preformed Silicone-Sealant Extrusion: Manufacturer's standard system consisting of cured low-modulus silicone extrusion, sized to fit opening widths, with a single-component, neutral-curing, Class 100/50 (low-modulus) silicone sealant for bonding extrusions to substrates.
 - 1. Products: Subject to compliance with requirements available products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Dow Corning Corporation; 123 Silicone Seal.
 - b. Momentive Performance Materials Inc.; US11000 UltraSpan.
 - c. Tremco Incorporated, an RPM company; Spectrem Simple Seal.
- M. Joint Sealant: ASTM C 920, single-component, neutral-curing silicone; Class 50/50 (medium modulus), Grade NS, Use NT related to exposure, and, as applicable to joint substrates indicated, Use O. Comply with Section 079200 - JOINT SEALANTS.
 - 1. Seals to air barrier and membrane wall materials shall be Dow Corning 758 medium modulus silicone complying with ASTM C920 as recommended by the sealant and air barrier manufacturer. The sealant shall be designed for adhering to low energy surfaces common in sheet or peel and stick weather resistant barriers. Compatibility and adhesion of sealants with air barrier materials shall be demonstrated by the sealant and membrane manufacturers, based on testing and shall be submitted in

writing. Test procedure shall be as indicated below and as specified herein.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements and other conditions affecting performance of the Work.
 - 1. Verify that substrates are sound and free of oil, grease, dirt, excess mortar, or other contaminants.
 - 2. Verify that concrete has cured and aged for minimum time period recommended by air-barrier manufacturer.
 - 3. Verify that concrete is visibly dry and free of moisture. Test for capillary moisture by plastic sheet method according to ASTM D 4263.
 - 4. Verify that masonry joints are flush and completely filled with mortar.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 SURFACE PREPARATION

- A. Clean, prepare, and treat substrate according to manufacturer's written instructions. Provide clean, dust-free, and dry substrate for air-barrier application.
- B. Mask off adjoining surfaces not covered by air barrier to prevent spillage and overspray affecting other construction.
- C. Remove grease, oil, bitumen, form-release agents, paints, curing compounds, and other penetrating contaminants or film-forming coatings from concrete.
- D. Remove fins, ridges, mortar, and other projections and fill honeycomb, aggregate pockets, holes, and other voids in concrete with substrate-patching membrane.
- E. Remove excess mortar from masonry ties, shelf angles, and other obstructions.
- F. Prepare, fill, prime, and treat joints and cracks in substrates. Remove dust and dirt from joints and cracks according to ASTM D 4258.
- G. Bridge and cover expansion joints and discontinuous wall-to-wall, deck-to-wall, and deck-to-deck joints with overlapping modified bituminous strips.
- H. At changes in substrate plane, apply sealant or termination mastic beads at sharp corners and edges to form a smooth transition from one plane to another.
- I. Cover gaps in substrate plane and form a smooth transition from one substrate plane to another with stainless-steel sheet mechanically fastened to structural framing to provide continuous support for air barrier.

3.3 JOINT TREATMENT

- A. Concrete and Masonry: Prepare, treat, rout, and fill joints and cracks in substrate according to ASTM C 1193 and air-barrier manufacturer's written instructions. Remove dust and dirt from joints and cracks complying with ASTM D 4258 before coating surfaces.
- B. Gypsum Sheathing: Fill joints greater than 1/8 inch with sealant according to ASTM C 1193 and air-barrier manufacturer's written instructions. Apply first layer of fluid air-barrier material at joints. Tape joints with joint reinforcing strip after first layer is dry. Apply a second layer of fluid air-barrier material over joint reinforcing strip.

3.4 AIR BARRIER MEMBRANE INSTALLATION

- A. General: Apply air barrier membrane to achieve a continuous air barrier according to air barrier manufacturer's written instructions.
- B. Install air barrier to dry surfaces at air and surface temperatures of 4°C (40°F) and above in accordance with manufacturer's recommendations, at locations indicated on Construction Documents.
- C. Prime substrate to receive air barrier membrane as required per manufacturers written instructions.
- D. Precut pieces of air barrier into easily handled lengths.
- E. Remove release linear and position membrane carefully before placing against the surface.
- F. Begin installation at the base of the wall placing top edge of membrane immediately below any masonry reinforcement or ties protruding from substrate.
- G. When properly positioned, place against surface by pressing firmly into place. Roll membrane with extension-handled countertop roller immediately after placement.
- H. Overlap adjacent pieces 50 mm (2 in.) and roll seams.
- I. Subsequent sheets of membrane applied above shall be positioned immediately below masonry reinforcement or ties. Bottom edge shall be slit to fit around reinforcing wires or ties, and membrane shall overlap the membrane sheet below by 50 mm (2 in.). Roll firmly into place.
- J. Seal around masonry reinforcing or ties and all penetrations with penetration & termination sealant.
- K. Coordinate the installation of air barrier with roof installer to ensure continuity of membrane with roof air barrier.
- L. At end of each working day seal top edge of air barrier to substrate with termination sealant.
- M. Do not expose air barrier membrane to sunlight for more than 150 days prior to

enclosure.

- N. Inspect installation prior to enclosing and repair punctures, damaged areas and inadequately lapped seams with a patch of the membrane sized to extend 150 mm (6 in.) in all directions from the perimeter of the affected area.

3.5 TRANSITION MEMBRANE INSTALLATION

- A. Install strips, transition membrane, and auxiliary materials according to air barrier manufacturer's written instructions to form a seal with adjacent construction and maintain a continuous air barrier. Install all transition membrane only after application of air barrier.
- B. Apply primer to substrates to receive transition membrane at required rate and allow to dry. Limit priming to areas that will be covered by transition tape in same day. Re-prime areas exposed for more than 24 hours.
- C. Prime glass-fiber-surfaced gypsum sheathing not covered with air membrane material with number of prime coats needed to achieve required bond, with adequate drying time between coats.
- D. Connect and seal exterior wall air barrier membrane continuously to roofing membrane air barrier, concrete below-grade structures, floor-to floor construction, exterior glazing and window systems, glazed curtain-wall systems, storefront systems, exterior louvers, exterior door framing, and other construction used in exterior wall openings, using accessory materials.
- E. At end of each working day, seal top edge transition membrane to substrate with termination sealant.
- F. Apply joint sealants forming part of air barrier assembly within sealant manufacturer's recommended application temperature ranges. Consult sealant manufacturer when sealant cannot be applied within these temperature ranges.
- G. Wall Openings: Prime concealed perimeter frame surfaces of windows, curtain walls, storefronts, and doors. Apply transition membrane so that a minimum of 3 inches (75 mm) of coverage is achieved over both substrates.
- H. Transition Membrane: Roll firmly to enhance adhesion.
- I. Fill gaps in perimeter frame surfaces of windows, curtain walls, storefronts, and doors, and miscellaneous penetrations of air barrier membrane with foam sealant.
- J. Repair punctures, voids, and deficient lapped seams in transition membrane. Slit and flatten fish-mouths and blisters. Patch with transition membrane extending 6 inches (150 mm) beyond repaired areas in strip direction.

3.6 FIELD QUALITY CONTROL

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

- B. Inspections: Air-barrier materials, accessories, and installation are subject to inspection for compliance with requirements. Inspections may include the following:
1. Continuity of air-barrier system has been achieved throughout the building envelope with no gaps or holes.
 2. Continuous structural support of air-barrier system has been provided.
 3. Masonry and concrete surfaces are smooth, clean, and free of cavities, protrusions, and mortar droppings.
 4. Site conditions for application temperature and dryness of substrates have been maintained.
 5. Maximum exposure time of materials to UV deterioration has not been exceeded.
 6. Surfaces have been primed.
 7. Laps in sheet materials have complied with the minimum requirements and have been shingled in the correct direction (or mastic applied on exposed edges), with no fishmouths.
 8. Termination mastic has been applied on cut edges.
 9. Air barrier has been firmly adhered to substrate.
 10. Compatible materials have been used.
 11. Transitions at changes in direction and structural support at gaps have been provided.
 12. Connections between assemblies (membrane and sealants) have complied with requirements for cleanliness, surface preparation and priming, structural support, integrity, and continuity of seal.
 13. All penetrations have been sealed.
- C. Tests: Contractor shall engage accredited testing agency to perform the following tests:
1. Water infiltration Testing: Air-barrier assemblies will be tested for evidence of water leakage according to AAMA 501.2.
 - a. Conduct test after cladding supports, framing, girts have been installed.
 - b. Perform one test for each 500 sq. ft. of installed air barrier or part thereof.
 2. Perform quantitative tests according to ASTM E 1186 "Standard Practices for Air Leakage Site Detection in Building Envelopes and Air Retarder Systems":
 - a. Chamber depressurization using detection liquids for 15% of brackets and penetrations.
 - b. Infrared scanning with pressurization/depressurization.
 3. Adhesion Testing: Air-barrier assemblies will be tested for minimum air-barrier adhesion of 16 lbf/sq. in. (110 kPa) according to ASTM D 4541 for each 600 sq. ft. (56 sq. m) of installed air barrier or part thereof.
- D. Air barriers will be considered defective if they do not pass tests and inspections.
1. Apply additional air-barrier material, according to manufacturer's written instructions, where inspection results indicate insufficient thickness.
 2. Remove and replace deficient air-barrier components for retesting as specified above.

- E. Repair damage to air barriers caused by testing; follow manufacturer's written instructions.

3.7 CLEANING AND PROTECTION

- A. Protect air-barrier system from damage during application and remainder of construction period, according to manufacturer's written instructions.
 - 1. Protect air barrier from exposure to UV light and harmful weather exposure as required by manufacturer. If exposed to these conditions for more than 60 days, remove and replace air barrier or install additional, full-thickness, air-barrier application after repairing and preparing the overexposed membrane according to air-barrier manufacturer's written instructions.
 - 2. Protect air barrier from contact with incompatible materials and sealants not approved by air-barrier manufacturer.
- B. Clean spills, stains, and soiling from construction that would be exposed in the completed Work, using cleaning agents and procedures recommended by manufacturer of affected construction.

3.8 WASTE MANAGEMENT

- A. Separate and dispose of waste in accordance with the Project's Waste Management Plan.

END OF SECTION

SECTION 074110 - METAL ROOF PANELS

PART 1 - GENERAL

1.1 SUMMARY

- A. Section includes preformed, field assembled, metal panels and all associated integral flashing, trims, and accessories, in the following locations:
 - 1. Canopy roof.
 - 2. Ceiling at cantilever over walkway.
 - 3. Elevator bulkhead.
 - 4. Interior cladding around elevator core.
- B. Related Documents and Sections: Examine Contract Documents for requirements that directly affect or are affected by Work of this Section. Other Documents and Sections that directly relate to work of this Section include, but are not limited to:
 - 1. General provisions of the Contract, including General and Supplementary Conditions, and Division 01 General Requirements Specification Sections.
 - 2. Section 061000 - ROUGH CARPENTRY.
 - 3. Section 076000 - FLASHING AND SHEET METAL
 - 4. Section 079200 - JOINT SEALANTS

1.2 SUBMITTALS

- A. Product Data, for each type of specified product, on metal types, finishes, and characteristics, including installation instructions.
- B. Shop Drawings: Indicate material profile, jointing pattern, jointing details, fastening methods, flashing, terminations, and installation details.
- C. Samples: Two samples for each exposed finish.
 - 1. Size: 12 inches long by actual panel width. Include fasteners, closures, and other metal panel accessories.

1.3 QUALITY ASSURANCE

- A. Perform Work in accordance with SMACNA standard details and requirements.
- B. Field formed panels are not allowed.
- C. Fire-Test-Response Characteristics: Provide roofing materials with the fire-test-response characteristics indicated as determined by testing identical products per test method below by UL or another testing and inspecting agency acceptable to authorities having jurisdiction. Materials shall be identified with appropriate markings of applicable

testing and inspecting agency.

1. Exterior Fire-Test Exposure: UL 790 Class A.

- D. Fabricator and Installer Qualifications: Company specializing in metal roof panel installations with minimum five years documented experience and approved by manufacturer.

1.4 DELIVERY, STORAGE, AND HANDLING

- A. Stack preformed and prefinished material to prevent twisting, bending, or abrasion, and to provide ventilation. Slope metal sheets to ensure drainage.
1. Store panels in a dry area at least 3 inches above floor.
 2. Keep panels wrapped until installation.
- B. Prevent contact with materials that may cause discoloration or staining.

1.5 FIELD CONDITIONS

- A. Weather Limitations: Proceed with installation only when existing and forecasted weather conditions permit assembly of metal panels to be performed according to manufacturer's written instructions and warranty requirements.

1.6 COORDINATION

- A. Coordinate sizes and locations of roof curbs, equipment supports, and roof penetrations with actual equipment provided.
- B. Coordinate metal panel installation with rain drainage work, flashing, trim, construction of soffits, and other adjoining work to provide a leak-proof, secure, and noncorrosive installation.

1.7 WARRANTY

- A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of metal panel systems that fail in materials or workmanship within specified warranty period.
1. Failures include, but are not limited to, the following:
 - a. Structural failures including rupturing, cracking, or puncturing.
 - b. Deterioration of metals and other materials beyond normal weathering.
 2. Warranty Period: Two years from date of Substantial Completion.
- B. Special Warranty on Panel Finishes: Manufacturer's standard form in which manufacturer agrees to repair finish or replace metal panels that show evidence of deterioration of factory-applied finishes within specified warranty period.
1. Exposed Panel Finish: Deterioration includes, but is not limited to, the following:

- a. Color facing more than 5 Hunter units when tested according to ASTM D 2244.
 - b. Chalking in excess of a No. 8 rating when tested according to ASTM D 4214.
 - c. Cracking, checking, peeling, or failure of paint to adhere to bare metal.
2. Finish Warranty Period: 20 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Design Requirements for Roof Panels: Provide an attachment schedule signed by a professional engineer licensed in the State of North Carolina and supporting calculations for UL 580, Class 90 wind uplift rating.
- B. Structural Performance: Capable of withstanding the effects of gravity loads and the following loads and stresses, based on testing according to ASTM E 1592:
 1. Wind Loads: As indicated in Drawings.
 2. Deflection Limits: Withstand test pressure with deflection no greater than 1/240 of the span and no evidence of material failure, structural distress, or permanent deformation exceeding 0.2 percent of the clear span.
 - a. Test Pressures: 150 percent of acting inward or outward wind-load design pressures:
- C. Seismic Performance: Panel assemblies capable of withstanding the effects of earthquake motions determined according to ASCE 7, "Minimum Design Loads for Buildings and Other Structures:" Section 9, "Earthquake Loads."

2.2 ROOF PANELS

- A. Basis-of-Design Product: The design for the metal roof panels is based on the following:
 1. Manufacturer: Metal Sales Manufacturing Corporation.
 2. Subject to compliance with requirements, other acceptable manufacturers with comparable products are the following:
 - a. AEP Span.
 - b. Centria Architectural Systems.
 - c. Firestone Metal Products, LLC.
 3. Product: "7/8" Corrugated"
 4. Configuration: Through-fastened panel, 7/8 inch high, 36 inches wide (32 inch net coverage), with corrugations spaced at 2-2/3 inches on center.

2.3 PANEL MATERIALS

- A. Steel sheet 24 Gauge, 50 KSI yield point, 52 KSI tensile strength, with Galvalume finish per ASTM A-792-83, AZ50, topcoat shall be manufacturer's standard clear acrylic coating.

1. Colors: As selected by the Architect from manufacturer's full range of standard and premium colors.
- B. Profile and Panel Coverage: As indicated on the Drawings, mechanically seamed.

2.4 ACCESSORIES

- A. Slip Sheet: ASTM D 226, Type II, No. 30 asphalt saturated roofing felt.
- B. Self-Adhering, High Temperature, Polyethylene-Faced Sheet Underlayment: ASTM D 1970, 0.030 inch thick composite waterproofing sheet with polyolefin film laminated to rubberized asphalt.
 1. Product: Subject to compliance with requirements, provide one of the following or approved:
 - a. Carlisle Coatings & Waterproofing Inc., Div. of Carlisle Companies Inc.; CCW WIP 300HT.
 - b. GCP Applied Technologies; Grace Ultra.
 - c. Henry Company; Blueskin PE200 HT.
- C. Flashing and Trim: Formed from metal matching panels. Provide flashing and trim as required to seal against weather and to provide finished appearance. Locations include, but are not limited to, bases, drips, sills, jambs, corners, endwalls, framed openings, rakes, fasciae, parapet caps, soffits, reveals, and fillers. Finish flashing and trim with same finish system as adjacent painted metal panels.

2.5 SHOP FABRICATION

- A. General: Coordinate roofing work with the work of Section 076200 - FLASHING AND SHEET METAL.
- B. Form sections true to shape, accurate in size, square, and free from distortion or defects.
- C. Form panels in full length where possible.
- D. Adjust individual panel widths to equalize areas rather than finishing with one odd sized panel.
- E. Sheet Metal Accessories: Fabricate flashing and trim to comply with recommendation in SMACNA's "Architectural Sheet Metal Manual" that apply to the design, dimensions, metal, and other characteristics of item indicated.
 1. Fabricate each metal flashing section in 10 foot runs.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Inspect roof deck substrate to verify substrates are dry, free of snow or ice, clean and smooth, free of depressions, waves, or projections, and roof deck is properly sloped.
- B. Verify field dimensions are as indicated in shop drawings prior to fabrication.

3.2 PREPARATION

- A. Install flashings and other sheet metal to comply with requirements of Section 076000 - FLASHING AND SHEET METAL.

3.3 INSTALLATION - GENERAL

- A. Apply roof underlayment in single layer from eave to ridge, laid perpendicular to slope; weather lap edges 4 inches and nail in place. Minimize nail quantity.
- B. Insulate dissimilar metal and incompatible surfaces with No. 30 felt, or by painting each surface of contact with bituminous coating.
- C. Seal metal joints watertight.

3.4 ROOF PANEL INSTALLATION

- A. Lay sheets with long dimension perpendicular to eaves. Apply pans beginning at eaves.
- B. Fully engage interlocking seams.
- C. Lap joints minimum 6 inches in direction of drainage.

3.5 CLEANING AND REPAIRING

- A. Replace damaged and defective panels and trim.
- B. Touch-up damaged paint.
- C. Fill exposed openings with closure gaskets or elastomeric sealants.
 - 1. Remove excess sealant materials from panel joints.
- D. Sweep clean panels, flashing and gutters.

3.6 WASTE MANAGEMENT

- A. Separate and dispose of waste in accordance with the Project's Waste Management Plan.

END OF SECTION

SECTION 074233 - SOLID PHENOLIC WALL PANELS

PART 1 - GENERAL

1.1 SUMMARY

- A. Section includes
 - 1. Phenolic exterior wall panels with exposed fasteners.
 - 2. Panel support framing, fasteners and joint treatment for wall panel system.
- B. Related Documents and Sections: Examine Contract Documents for requirements that directly affect or are affected by Work of this Section. Other Documents and Sections that directly relate to work of this Section include, but are not limited to:
 - 1. General provisions of the Contract, including General and Supplementary Conditions, and Division 01 General Requirements Specification Sections.
 - 2. Section 042000 - UNIT MASONRY
 - 3. Section 055000 - METAL FABRICATIONS.
 - 4. Section 054000 - COLD-FORMED METAL FRAMING.
 - 5. Section 072100 - THERMAL INSULATION.
 - 6. Section 076200 - SHEET METAL FLASHING AND TRIM.

1.2 SYSTEM DESCRIPTION

- A. Exterior Wall Panel Assembly: Complete engineered wall cladding system designed as rainscreen, and comprising the following components:
 - 1. Horizontal Z-Girts: Extruded aluminum Z-sections secured to cold-formed metal framing, through exterior sheathing, with profile to accommodate thickness of rigid insulation.
 - 2. Vertical J-Channels: Extruded aluminum J-sections and hat-sections secured to horizontal girts for direct support of rainscreen panels.
 - 3. Rainscreen Panels: Rectangular panels secured to vertical J-channels with exposed fasteners.
 - 4. Joints Between Panels: 3/8 inch (10 mm) wide.

1.3 PERFORMANCE REQUIREMENTS

- A. General Performance: Exterior wall panel assemblies shall comply with performance requirements without failure due to defective manufacture, fabrication, installation, or other defects in construction.
- B. Structural Performance: Provide exterior wall panel assemblies capable of withstanding the effects of the following loads and stresses within limits and under conditions indicated, based on testing according to ASTM E 330:

1. Wind Loads: Determine loads based on the following minimum design wind pressures:
 - a. 53 psf within 10 feet of corner.
 - b. 37 psf elsewhere.
 2. Deflection Limits: Exterior wall panel assemblies shall withstand wind loads with horizontal deflections no greater than 1/175 of the span at the perimeter and 1/60 of the span anywhere in the panel.
- C. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes by preventing buckling, opening of joints, overstressing of components, failure of connections, and other detrimental effects. Base calculations on surface temperatures of materials due to both solar heat gain and nighttime-sky heat loss.
1. Temperature Change (Range): 120 deg F (67 deg C), ambient; 180 deg F (100 deg C), material surfaces.
- D. Air Infiltration and Water Penetration: At rainscreen assembly, air infiltration and water penetration will be controlled by separate air barrier system specified in Section 072700 - AIR BARRIER MEMBRANES, which will be tested accordingly.

1.4 SUBMITTALS

- A. Product Data: For each type of product indicated. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for each type of exterior wall panel and accessory.
- B. Shop Drawings: Show fabrication and installation layouts of exterior wall panels; details of edge conditions, joints, panel profiles, comers, anchorages, attachment system, trim, flashings, closures, and accessories; and special details. Distinguish among factory-, shop-, and field-assembled work.
1. Accessories: Include details of the following items, at a scale of not less than 1 -1/2 inches per 12 inches (1;10):
 - a. Flashing and trim.
 - b. Anchorage systems.
- C. Samples for Initial Selection: For each type of exterior wall panel indicated with factory-applied color finishes.
1. Include similar Samples of trim and accessories involving color selection.
- D. Samples for Verification; For each type of exposed finish required, prepared on Samples of size indicated below:
1. Exterior Wall Panels: Minimum 12 x 12 inches (300 x 300 mm). Include fasteners, closures, and other exterior wall panel accessories.
 - a. Panels: Include four-way joint for each panel type.
 2. Trim and Closures: 12 inches (300 mm) long. Include fasteners and other exposed accessories.

3. Fasteners: Sample of exposed fastener.
4. Accessories: 12-inch- (300-mm-) long Samples for each type of accessory.
- E. Coordination Drawings: Exterior elevations, drawn to scale, on which the following items are shown and coordinated with each other, using input from installers of the items involved:
 1. Wall panels and attachments.
 2. Girts.
 3. Stud framing.
 4. Wall-mounted items including doors, windows, louvers, and lighting fixtures.
 5. Penetrations of wall by pipes and utilities.
- F. Qualification Data: For professional engineer.
- G. Product Test Reports: Based on evaluation of comprehensive tests performed by a qualified testing agency, for each product.
- H. Field quality-control reports.
- I. Maintenance Data: For metal wall panels to include in maintenance manuals.
- J. Warranties: Samples of special warranties.

1.5 QUALITY ASSURANCE

- A. Testing Agency Qualifications: Qualified according to ASTM E 329 for testing indicated.
- B. Source Limitations: Obtain each type of exterior wall panel from single source from single manufacturer.
- C. Fire-Resistance Ratings: Where indicated, provide exterior wall panels identical to those of assemblies tested for fire resistance per ASTM E 119 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.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Deliver components, sheets, exterior wall panels, and other manufactured items so as not to be damaged or deformed. Package exterior wall panels for protection during transportation and handling.
- B. Unload, store, and erect exterior wall panels in a manner to prevent bending, warping, twisting, and surface damage.
- C. Store exterior wall panels vertically, covered with suitable weathertight and ventilated covering. Store exterior wall panels to ensure dryness, with positive slope for drainage of water. Do not store exterior wall panels in contact with other materials that might cause staining, denting, or other surface damage. Do not allow storage space to exceed

120 deg F (49 deg C).

- D. Retain strippable protective covering on exterior wall panel for period of panel installation.

1.7 PROJECT CONDITIONS

- A. Weather Limitations: Proceed with installation only when existing and forecasted weather conditions permit assembly of exterior wall panels to be performed according to manufacturer's written instructions and warranty requirements.
- B. Field Measurements: Verify locations of structural members and wall opening dimensions, by field measurements and identify conditions requiring unique dimensions before exterior wall panel fabrication. Indicate field measurements on Shop Drawings.

1.8 COORDINATION

- A. Coordinate exterior wall panel assemblies with rain drainage work, flashing, trim, and construction of studs and other adjoining work to provide a leak proof, secure, and noncorrosive installation.

1.9 WARRANTY

- A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of exterior wall panel assemblies that fail in materials or workmanship within specified warranty period.
 - 1. Failures include, but are not limited to, the following:
 - a. Structural failures, including rupturing, cracking, or puncturing.
 - b. Deterioration of phenolic resin, metals and other materials beyond normal weathering.
 - c. Color loss.
 - 2. Warranty Period: 10 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 SOLID PHENOLIC WALL PANELS

- A. Manufacturer: Subject to compliance with these specifications, provide products manufactured by one of the following:
 - 1. Trespa North America.
 - 2. Richlite.
 - 3. Prodema.
- B. General: Provide exterior wall panels shop-fabricated from reinforced phenolic resin; with profiles and dimensions as indicated. Include attachment system components and

accessories required for rainscreen system.

- C. Phenolic Resin Panel Materials: Solid, reinforced resin panels with nonporous surfaces and edges, manufactured under high pressure and temperature.
 - 1. Resin: Thermosetting phenolic resins, pigmented to produce selected color.
 - 2. Reinforcement: Cellulose fibers distributed homogeneously throughout resin.
 - 3. Fire-Retardant Core: Noncombustible, with the following surface-burning characteristics as determined by testing identical products per ASTM E 84 by UL or another testing and inspecting agency acceptable to authorities having jurisdiction:
 - a. Flame-Spread Index: 5 or less.
 - b. Smoke-Developed Index: 5 or less.
- D. Physical Properties of Panels: Provide panels that comply with the ICC-ES Acceptance Criteria for Polymer-based and Polymer-modified Exterior and Interior Wall cladding (AC92) dated April 2002, and the following:
 - 1. Density; At least 87.5 lb/ft³ when measured according to ASTM D792.
- E. Phenolic Exterior Wall Panels:
 - 1. Panel Thickness: 1/2 inch.
 - 2. Panel Dimensions: As indicated on Drawings.
 - 3. Surface: Decorative, dirt-resistant surface produced by curing with electron beam to provide resistance to chemicals and dirt.
 - a. Color for exposed surface: As selected by the Architect.
 - b. Color for concealed surface: Manufacturer's standard black color.
 - c. Sheen: Satin.
- F. Attachment System Components: Formed from extruded aluminum.
 - 1. Include manufacturer's standard perimeter extrusions with integral weather stripping, panel stiffeners, panel clips and anchor channels.
- G. Exposed Panel Fasteners:
 - 1. Screws: Stainless steel screws with round heads; length as required to penetrate panels and furring member through spacer washer.
 - 2. Spacer Washers: 1/2 inch (13 mm) long, stainless steel cylinders of diameter to enclose screw shank.

2.2 SUPPORT FRAMING ASSEMBLY

- A. Materials:
 - 1. Aluminum Extrusions: Provide alloy and temper recommended by manufacturer for strength, corrosion resistance, and application of required finish, but not less than 22,000 psi (150 MPa) ultimate tensile strength and not less than 0.125 inch (3.2 mm) thick at any location.

2. Galvanized Sheet Steel: ASTM C 645, cold-formed metallic-coated steel sheet, ASTM A 653/A 653M, G60 (Z180) hot-dip galvanized or coating with equivalent corrosion resistance unless otherwise indicated.
 3. Stainless Steel Fasteners: Series 300 stainless steel.
- B. Horizontal Subgirts: Manufacturer's standard Z-shaped extruded aluminum sections 0.064-inch (1.63-mm) nominal thickness.
 - C. Vertical Furring Channels: Manufacturer's standard J-shaped and hat-shaped extruded aluminum sections 0.064-inch (1.63-mm) nominal thickness.
 - D. Zee Clips: 0.079-inch (2.01 -mm) nominal thickness.
 - E. Base or Sill Angles or Channels: 0.079-inch (2.01 -mm) nominal thickness.
 - F. Hat-Shaped, Rigid Furring Channels:
 1. Nominal Thickness: As required to meet performance requirements.
 2. Depth: 1 inch (25 mm).
 - G. Fasteners for Miscellaneous Metal Framing: Of type, material, size, corrosion resistance, holding power, and other properties required to fasten miscellaneous metal framing members to substrates.

2.3 MISCELLANEOUS MATERIALS

- A. Aluminum Extrusions: ASTM B 221, alloy and temper recommended by manufacturer for type of use and finish indicated.
- B. Fasteners: Self-tapping screws, bolts, nuts, self-locking rivets and bolts, end-welded studs, and other suitable fasteners designed to withstand design loads. Provide exposed fasteners with heads matching color of phenolic exterior wall panels by means of plastic caps or factory-applied coating. Provide EPDM, PVC, or neoprene sealing washers.

2.4 ACCESSORIES

- A. Wall Panel Accessories: Provide components required for a complete exterior wall panel assembly including trim, copings, fasciae, mullions, sills, corner units, clips, flashings, fillers, closure strips, and similar items. Match material and finish of exterior wall panels unless otherwise indicated.
- B. Flashing and Trim: Provide flashing and trim as required to seal against weather and to provide finished appearance.
 1. Material: Formed from 0.018-inch- (0.46-mm-) minimum thickness, 70 percent resin Kynar aluminum coil coating.
 2. Finish flashing and trim with same color as adjacent exterior wall panels.
 3. Locations include, but are not limited to, bases, drips, sills, jambs, corners, endwalls, framed openings, rakes, fasciae, parapet caps, soffits, reveals, and fillers.

- 4. Closure Trim:
 - a. Comer Closure; Sheet metal bent to form angle, with predrilled screw holes.
 - b. Horizontal Joint Closure: Sheet metal strip with predrilled screw holes.
- C. Sheet Metal Flashing: Stainless-steel flashing complying with Division 7 Section "Sheet Metal Flashing and Trim" for installation at window and door heads and where indicated.
- D. Insect Screen: Corrosion-resistant wire mesh screen material for installation at bottom edge of panel system.

2.5 FABRICATION

- A. General: Fabricate and finish exterior wall panels, support framing and accessories at the factory to greatest extent possible, by manufacturer's standard procedures and processes, as necessary to fulfill indicated performance requirements demonstrated by laboratory testing. Comply with indicated profiles and with dimensional and structural requirements.
 - 1. Dimensions: Prior to delivery to site, cut panels and support components in shop to final dimensions based on verified field dimensions as shown on approved shop drawings.
- B. Exterior Wall Panels, General: Factory form panels to meet the following requirements:
 - 1. Form panel lines, breaks, and angles to be sharp and true, with surfaces free from warp and buckle.
 - 2. Fabricate panels with sharply cut edges, with no displacement of face sheets or protrusion of core material.
 - 3. Fabricate panels with panel stiffeners, as required to comply with deflection limits, attached to back of panels with structural silicone sealant or bond tape.
 - 4. Panel Labels: Apply temporary label to back surface of each panel after fabrication, to identify its place in the installation sequence.
- C. Dimensional Tolerance of Panels: Fabricated panel dimensions shall vary no more than the following tolerances:
 - 1. Panel Thickness: Within 0.02 inch (0.5 mm) of specified thickness.
 - 2. Overall Dimensions of Panels: Within 3/16 inch (5.0 mm) of width and length indicated on Drawings, as required to maintain specified space between adjacent panels.
 - 3. Squareness: No more than 1/8 inch in 10 feet (1 mm in 1 m) deviation from perpendicular.
- D. Fastener Holes in Panels: Shop-drill holes for fasteners in spacing as indicated on Drawings, but no greater than 16 inches (400 mm) on center, as determined by engineering analysis.
 - 1. Identify locations of fixed and mobile points and drill fastener holes accordingly. Locate two holes for fixed points near the center of each panel; the remaining holes

- will be mobile points.
- a. Fixed Point Fastener Hole Diameter: 5/16 inch (8 mm).
- b. Mobile Point Fastener Hole Diameter: As recommended by panel manufacturer for project conditions and application.
- 2. Drill fastener holes at the following distances from the edges:
 - a. Distance from top and bottom edges: 2 inches (51 mm).
 - b. Distance from vertical edges: 2 inches (51 mm).
- E. Sheet Metal Accessories: Fabricate flashing and trim to comply with recommendations in SMACNA's "Architectural Sheet Metal Manual" that apply to design, dimensions, metal, and other characteristics of item indicated.
 - 1. Form exposed sheet metal accessories that are without excessive oil canning, budding, and tool marks and that are true to line and levels indicated, with exposed edges folded back to form hems.
 - 2. Seams for Aluminum: Fabricate nonmoving seams with flat-lock seams. Form seams and seal with epoxy seam sealer. Rivet joints *for* additional strength.
 - 3. Seams for Other Than Aluminum: Fabricate nonmoving seams in accessories with flat-lock seams. Tin edges to be seamed, form seams, and solder.
 - 4. Conceal fasteners and expansion provisions where possible. Exposed fasteners are not allowed on faces of accessories exposed to view.
 - 5. Fabricate cleats and attachment devices from same material as accessory being anchored or from compatible, noncorrosive metal recommended by exterior wall panel manufacturer.
 - a. Size: As recommended by SMACNA's "Architectural Sheet Metal Manual" or exterior wall panel manufacturer for application, but not less than thickness of metal being secured.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances, exterior wall panel supports, and other conditions affecting performance of the Work.
 - 1. Examine wall framing to verify that girts, angles, channels, studs, and other structural panel support members and anchorage have been installed within alignment tolerances required by exterior wall panel manufacturer.
 - 2. Examine wall sheathing to verify that sheathing joints are supported by framing or blocking and that installation is within flatness tolerances required by exterior wall panel manufacturer.
 - 3. Verify that weather-resistant sheathing paper has been installed over sheathing or backing substrate to prevent air infiltration or water penetration.
- B. Examine roughing-in for components and systems penetrating exterior wall panels to verify actual locations of penetrations relative to seam locations of panels before panel

installation.

- C. For the record, 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. Coordinate installation of panel assembly with rain drainage work; flashing; trim; and construction of soffits, roofing, parapets, walls, and other adjoining work to provide a leakproof, secure, and noncorrosive installation
- B. Miscellaneous Framing: Install subgirts, base angles, sills, furring, and other miscellaneous wall panel support members and anchorage according to ASTM C 754 and exterior wall panel manufacturer's written instructions.

3.3 EXTERIOR WALL PANEL INSTALLATION

- A. Rainscreen-Assembly Installation: Provide manufacturer's standard open-joint, rainscreen-assembly with horizontal, subgirts and vertical channels that provides support and complete secondary drainage system, draining at base of wall.
- B. General: Install exterior wall panels according to manufacturer's written instructions in orientation, sizes, and locations indicated on Drawings. Install panels perpendicular to girts and subgirts unless otherwise indicated. Anchor panels and other components of the Work securely in place, with provisions for thermal and structural movement.
 - 1. Commence exterior wall panel installation and install minimum of 300 sq. ft. (27.8 sq. m) in presence of factory-authorized representative.
 - 2. Shim or otherwise plumb substrates receiving exterior wall panels.
 - 3. Flash exterior wall panels at perimeter of all openings. Do not begin installation until weather barrier and flashings that will be concealed by panels are installed.
 - 4. Install flashing and trim as exterior wall panel work proceeds.
 - 5. Apply elastomeric sealant continuously between metal base channel (sill angle) and concrete, and elsewhere as indicated or, if not indicated, as necessary for waterproofing.
 - 6. Provide weathertight escutcheons for pipe and conduit penetrating exterior walls.
- C. Fasteners: Use stainless-steel fasteners for surfaces exposed to the exterior and aluminum or galvanized-steel fasteners for surfaces exposed to the interior.
- D. Metal Protection: Where dissimilar metals will contact each other or corrosive substrates, protect against galvanic action as recommended by exterior wall panel manufacturer.
- E. Support System Installation: Install attachment system required to support exterior wall panels and to provide a complete rainscreen wall assembly including subgirts, perimeter extrusions, tracks, drainage channels, panel clips, and anchor channels.

1. Include attachment to supports, panel-to-panel joinery, panel-to-dissimilar- material joinery, and panel-system joint seals.
 2. Do not begin installation until weather barrier and flashings mat will be concealed by composite panels are installed.
 3. Install horizontal subgirts with fasteners supported by exterior cold-formed metal framing studs. Coordinate Z-girt locations with required fastener spacing and with installation of mineral fiber rigid insulation specified in Section 07212.
 4. After rigid insulation is secured in place, install vertical channels supported by horizontal subgirts, at locations, spacings, and with fasteners recommended by manufacturer. Coordinate vertical channels with panel joint locations and requirements for spacing fasteners at specified distance from panel edges.
- F. Panel Installation; Install wall panels to allow individual panels to "free float" and be installed and removed without disturbing adjacent panels.
1. Align panels according to procedures recommended by panel manufacturer.
 2. Fasten panels to vertical channels using screws and washer spacers.
 3. Begin with the fixed point fasteners on each panel, followed by mobile points as recommended by manufacturer. Leave horizontal and vertical joints with the following joint widths:
 - a. Vertical: 3/8 inch (10 mm).
 - b. Horizontal: 3/8 inch (10 nun).
 4. Do not apply sealants to joints unless otherwise indicated on Drawings.

3.4 ACCESSORY INSTALLATION

- A. General: Install accessories with positive anchorage to building and weathertight mounting and provide for thermal expansion. Coordinate installation with flashings and other components.
1. Install components required for a complete exterior wall panel assembly including trim, copings, comers, seam covers, flashings, fillers, closure strips, and similar items.
- B. Flashing and Trim: Comply with performance requirements, manufacturer's written installation instructions, and SMACNA's "Architectural Sheet Metal Manual." Provide concealed fasteners where possible, and set units true to line and level as indicated. Install work with laps, joints, and seams that will be permanently watertight and weather resistant.
1. Install exposed flashing and trim that is without excessive oil canning, buckling, and tool marks and that is true to line and levels indicated, with exposed edges folded back to form hems. Install sheet metal flashing and trim to fit substrates and to result in waterproof and weather-resistant performance.
 2. Expansion Provisions: Provide for thermal expansion of exposed flashing and trim. Space movement joints at a maximum of 10 feet (3 m) with no joints allowed within 24 inches (610 mm) of comer or intersection. Where lapped expansion provisions cannot be used or would not be sufficiently weather resistant and waterproof, form

expansion joints of intermeshing hooked flanges, not less than 1 inch (25 mm) deep, filled with mastic sealant (concealed within joints).

- C. Installation of Closure Trim: Secure trim to panels with finished surface of metal facing exterior.
 - 1. Typical Horizontal Joints: Prior to installation of each panel, secure brakemetal closure strip to back of bottom panel edge using manufacturer's clip anchor, for closure at horizontal joints.
 - 2. Exterior Corners: Prior to installation of each panel at exterior corners, secure brakemetal closure strip to back of beveled panel edge using manufacturer's clip anchor, for closure at corner.

3.5 ERECTION TOLERANCES

- A. Installation Tolerances: Shim and align exterior wall panel units within installed tolerance of 1/4 inch in 20 feet (6 mm in 6 m), nonaccumulative, on level, plumb, and location lines as indicated and within 1/8-inch (3-mm) offset of adjoining faces and of alignment of matching profiles.

3.6 QUALITY CONTROL

- A. The Contractor shall perform daily inspections of panel installation to maintain and confirm that tolerances are being met.
- B. The Owner may elect to engage a third-party inspection and testing agency to verify that installed panel system meets performance requirements and tolerances.

3.7 CLEANING

- A. Remove temporary protective coverings and strippable films, if any, as exterior wall panels are installed unless otherwise indicated in manufacturer's written installation instructions. On completion of exterior wall panel installation, clean finished surfaces as recommended by panel manufacturer. Maintain in a clean condition during construction.
- B. After exterior wall panel installation, clear weep holes and drainage channels of obstructions and dirt.
- C. Replace exterior wall panels that have been damaged or have deteriorated beyond successful repair by finish touchup or similar minor repair procedures.

3.8 WASTE MANAGEMENT

- A. Separate and dispose of waste in accordance with the Project's Waste Management Plan.

END OF SECTION

SECTION 075423 - THERMOPLASTIC POLYOLEFIN ROOFING

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes the following:
 - 1. Fully adhered single-ply membrane roofing.
 - 2. Gypsum protection board.
 - 3. Roof insulation.
- B. Related Documents and Sections: Examine Contract Documents for requirements that directly affect or are affected by Work of this Section. A list of those Documents and Sections include, but is not limited to the following:
 - 1. Drawings and general provisions of the Contract, including General and Supplementary Conditions, and Division 01 General Requirements Specification Sections, apply to this Section.
 - 2. Section 061053 - MISCELLANEOUS ROUGH CARPENTRY.
 - 3. Section 072100 - THERMAL INSULATION.
 - 4. Section 076200 - SHEET METAL FLASHING AND TRIM.
 - 5. Section 077200 - ROOF ACCESSORIES

1.2 SYSTEM DESCRIPTION

- A. Definitions:
 - 1. Roofing Terminology: Refer to ASTM D1079 for definition of terms related to roofing work not otherwise defined in this Section.
- B. Performance Requirements:
 - 1. General: Install sheet membrane roofing and base flashing that are watertight; will not permit the passage of liquid water; and will withstand wind loads, thermally induced movement, and exposure to weather without failure.
 - 2. Wind Uplift Resistance: Design roofing system to resist wind uplift pressures at the project locale when tested according to UL 580 or UL 1897:
 - 3. Hurricane and Wind-Borne Debris Requirements: The project locale is categorized by North Carolina Building Code as a wind-borne debris region, requiring materials and construction practices designed to withstand potential wind speeds of up to 120 mph.
 - 4. Solar Reflectance Index:
 - a. Roof Slopes of 2:12 or Less: Not less than 78 when calculated according to ASTM E1980, based on testing identical products by a qualified testing agency.

- b. Roof Slopes of 2:12 or More: Not less than 29 when calculated according to ASTM E1980, based on testing identical products by a qualified testing agency.
- 5. Material Compatibility: Provide roofing materials that are compatible with one another under conditions of service and application required, as demonstrated by roofing system manufacturer based on testing and field experience.
- C. Roofing System Design: Provide a single-ply roofing system that complies with roofing system manufacturer's written design instructions and with the following:
 - 1. SPRI's "Wind Design Guide for Adhered Roofing Systems," exposure category and system design as indicated on the Drawings.

1.3 SUBMITTALS

- A. Product Data: For each type of roofing product specified. Include data substantiating that materials comply with requirements.
- B. Shop Drawings: Include plans, sections, and details of the following:
 - 1. Base flashings and membrane terminations.
 - 2. Tapered insulation, including slopes.
 - 3. Fastener layouts for each type of fastener and substrate.
- C. Samples for Verification: Of the following products:
 - 1. 12-by-12-inch square of sheet roofing, of color specified, including T-shaped side and end lap seam.
 - 2. 12-by-12-inch square of roof insulation.
 - 3. 12-by-12-inch square of walkway pads.
 - 4. 6 insulation fasteners of each type, length, and finish.
- D. Installer Certificates: Signed by roofing system manufacturer certifying that Installer is approved, authorized, or licensed by manufacturer to install specified roofing system.
- E. Manufacturer Certificates: Signed by roofing manufacturer certifying that the roofing system complies with requirements specified in the "Performance Requirements" Article. Upon request, submit evidence of meeting requirements.
 - 1. Include certification that ponding water conditions will not have an effect upon performance of the roof system.
- F. Qualification Data: For firms and persons specified in the "Quality Assurance" Article to demonstrate their capabilities and experience. Include lists of completed projects with project names and addresses, names and addresses of architects and owners, and other information specified.
- G. Product Test Reports: Based on evaluation of tests performed by manufacturer and witnessed by a qualified independent testing agency, indicate compliance of components of roofing system with requirements based on comprehensive testing of

current product compositions.

- H. Research/Evaluation Reports: Evidence of roofing system's compliance with building code in effect for Project, from a model code organization acceptable to authorities having jurisdiction.
- I. Maintenance Data: For roofing system to include in the maintenance manuals specified in Division 01.
- J. Warranty: Sample copy of roofing system manufacturer's warranty stating obligations, remedies, limitations, and exclusions of warranty.
 - 1. Include special project conditions indicating ponding water conditions will not have an effect upon performance of the roof system or negate any provisions of the warranty.
 - 2. Inspection Report: Copy of roofing system manufacturer's inspection report of completed roofing installation.

1.4 QUALITY ASSURANCE

- A. Installer Qualifications: Engage an experienced installer to perform work of this Section who has specialized in installing roofing similar to that required for this Project and who is approved, authorized, or licensed by the roofing system manufacturer to install manufacturer's product.
- B. Fire-Test-Response Characteristics: Provide roofing materials with the fire-test-response characteristics indicated as determined by testing identical products per test method indicated below by UL, FM, or another testing and inspecting agency acceptable to authorities having jurisdiction. Identify materials with appropriate markings of applicable testing and inspecting agency.
 - 1. Exterior Fire-Test Exposure: Class A; ASTM E108, for application and slopes indicated.
 - 2. Fire-Resistance Ratings: ASTM E119, for fire-resistance-rated roof assemblies of which roofing materials are a part.
- C. Preliminary Roofing Conference: Before starting roof deck construction, conduct conference at Project site. Meet with the same participants and review the same items listed for the preinstallation conference. In addition, review status of submittals and coordination of work related to roof construction. Notify participants at least 5 working days before conference.
- D. Preinstallation Conference: Before installing roofing system, conduct conference at Project site to comply with requirements of Division 01.
 - 1. Meet with Owner; Architect; Owner's insurer, if applicable; testing and inspecting agency representative; roofing Installer; roofing system manufacturer's representative; deck Installer; and installers whose work interfaces with or affects roofing, including installers of roof accessories and roof-mounted equipment.
 - 2. Review methods and procedures related to roofing installation, including manufacturer's written instructions.

3. Examine deck substrate conditions and finishes for compliance with requirements, including flatness and fastening.
4. Review loading limitations of deck during and after roofing.
5. Review flashings, special roofing details, roof drainage, roof penetrations, equipment curbs, and condition of other construction that will affect roofing.
6. Review governing regulations and requirements for insurance, certificates, and inspection and testing, if applicable.
7. Review temporary protection requirements for roofing system during and after installation.
8. Review roof observation and repair procedures after roofing installation.
9. Document proceedings, including corrective measures or actions required, and furnish copy of record to each participant.

1.5 DELIVERY, STORAGE, AND HANDLING

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

1.6 WARRANTY

- A. Manufacturer System Warranty (only products purchased from Manufacturer are covered under System Warranty).
 1. Warranty Period: 20 years from date of Substantial Completion.
 2. Upon successful completion of the work to Manufacturer's satisfaction and receipt of final payment, the Manufacturer System Warranty shall be issued.
- B. Applicator/Roofing Contractor Warranty
 1. The Applicator shall supply the Owner with a separate workmanship warranty. In the event any work related to roofing, flashing, or metal is found to be within the Applicator warranty term, defective or otherwise not in accordance with the Contract Documents, the Applicator shall repair that defect at no cost to the Owner. The

Applicator's warranty obligation shall run directly to the Owner, and a copy shall be sent to Manufacturer.

C. Owner Responsibility

1. Owner shall notify both Manufacturer and the Applicator of any leaks as they occur during the time period when both warranties are in effect.

1.7 PROJECT CONDITIONS

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

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Basis-of-Design Manufacturer: Firestone Ultraply TPO Sheet Membrane or an Architect acceptable equivalent by one of the following:
 1. Carlisle SynTec Incorporated
 2. Johns Manville.
 3. JPS Elastomerics Corp.; Roofing Systems Division.
 4. Versico, Inc.

2.2 THERMOPLASTIC POLYOLEFIN SHEET

- A. Reinforced Thermoplastic Polyolefin Sheet: Uniform, flexible elastomer sheet formed from a thermoplastic polyolefin, reinforced, of the following thickness, exposed face color, and physical properties:
 1. Thickness: 60 mils.
 2. Exposed Face Color: White; refer to reflectance requirements in system description..
 3. Physical Properties: Provide reinforced thermoplastic polyolefin sheets with the following properties as determined per ASTM test method indicated:
 - a. Breaking Strength: 225 lbf, ASTM D751, grab method.
 - b. Elongation at Break: 15 percent; ASTM D751.
 - c. Tearing Strength: 55 lbf minimum; ASTM D751, Procedure B.
 - d. Resistance to Heat Aging: No reduction in breaking strength, elongation at break, and tearing strength after 168 hours at 240 deg F; ASTM D573.
 - e. Ozone Resistance: No cracks after 168 hours' exposure of 50 percent elongated sample at 100 deg F and 100-pphm ozone; ASTM D1149, Procedure B.
 - f. Water Absorption: Less than 4 percent mass change after 168 hours' immersion at 158 deg F; ASTM D471.

- g. Weather Resistance: No cracks or crazing after 4000 hours' exposure to xenon-arc; ASTM G26.

2.3 SUBSTRATE AND PROTECTION BOARD

- A. Substrate Board: ASTM C 1396, Type X gypsum board, 5/8 inch thick.
- B. Fasteners: Factory-coated steel fasteners and metal or plastic plates meeting corrosion-resistance provisions in FMG 4470, designed for fastening substrate panel to roof deck.

2.4 AUXILIARY MATERIALS

- A. General: Furnish auxiliary materials recommended by roofing system manufacturer for intended use and compatible with membrane roofing material.
 - 1. Furnish liquid-type auxiliary materials that meet VOC limits of authorities having jurisdiction.
- B. Sheet Flashing: Manufacturer's standard sheet flashing of same material, type, thickness, and color as sheet membrane.
- C. Bonding Adhesive: Manufacturer's standard bonding adhesive.
- D. Board Fasteners: Factory-coated steel fasteners and metal or plastic plates meeting corrosion-resistance provisions of FM 4470, designed for fastening roof insulation to substrate, and acceptable to roofing system manufacturer
- E. Miscellaneous Accessories: Provide pourable sealers, preformed cone and vent sheet flashings, preformed inside and outside corner sheet flashings, T-joint covers, seam calk, termination reglets, and other accessories recommended by roofing system manufacturer for intended use.

2.5 ROOF INSULATION

- A. General: Preformed roof insulation boards manufactured or approved by TPO membrane roofing manufacturer, selected from manufacturer's standard sizes suitable for application, of thicknesses indicated.
- B. Polyisocyanurate Board Insulation: ASTM C 1289, Type II, Class 1, Grade 2 (20 psi minimum compressive strength), felt or glass-fiber mat facer on both major surfaces.
 - 1. Minimum Thickness: As required to achieve minimum aged R-value (R-25) required for roof assembly.
- C. Tapered Insulation: Provide factory-tapered insulation boards fabricated to slope of 1/4 inch per 12 inches (1:48) unless otherwise indicated.
- D. Provide preformed saddles, crickets, tapered edge strips, and other insulation shapes where indicated for sloping to drain. Fabricate to slopes indicated.

2.6 INSULATION ACCESSORIES

- A. General: Furnish roof insulation accessories recommended by insulation manufacturer for intended use and compatible with sheet roofing material.
- B. Fasteners: Factory-coated steel fasteners and metal or plastic plates complying with corrosion-resistance provisions in FM Approvals 4470, designed for fastening roof insulation to substrate, and acceptable to roofing system manufacturer.
- C. Full-Spread Applied Insulation Adhesive: Insulation manufacturer's recommended spray-applied, low-rise, two-component urethane adhesive formulated to attach roof insulation to substrate or to another insulation layer.

2.7 WALKWAYS

- A. Walkway Pads: Factory-formed, nonporous, heavy-duty, slip-resisting, surface-textured walkway pads, approximately 5/16 inch thick, of materials acceptable to roofing system manufacturer.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates, areas, and conditions under which roofing will be applied, with Installer present, for compliance with requirements.
- B. Verify that roof openings and penetrations are in place and set and braced and that roof drains are properly clamped into position.
- C. Verify that wood nailers are in place and secured and match thicknesses of insulation required.
- D. Do not proceed with installation until after the minimum concrete curing period recommended by roofing system manufacturer.
- E. Do not proceed with installation until unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Clean substrate of dust, debris, and other substances detrimental to roofing installation according to roofing system manufacturer's written instructions. Remove sharp projections.
- B. Prevent materials from entering and clogging roof drains and conductors and from spilling or migrating onto surfaces of other construction. Remove roof-drain plugs when no work is taking place or when rain is forecast.
- C. Complete terminations and base flashings and provide temporary seals to prevent water from entering completed sections of the roofing system at the end of the workday or when rain is forecast. Remove and discard temporary seals before beginning work

on adjoining roofing.

3.3 INSULATION INSTALLATION

- A. Coordinate installing roofing system components so insulation is not exposed to precipitation or left exposed at the end of the workday.
- B. Comply with roofing system manufacturer's written instructions for installing roof insulation.
- C. Install tapered insulation under area of roofing to conform to slopes indicated and to Shop Drawings.
- D. Install one or more layers of insulation under area of roofing to achieve required thickness. Where overall insulation thickness is 2 inches or greater, install required thickness in 2 or more layers with joints of each succeeding layer staggered from joints of previous layer a minimum of 6 inches in each direction.
- E. Trim surface of insulation where necessary at roof drains so completed surface is flush and does not restrict flow of water.
- F. Install insulation with long joints of insulation in a continuous straight line with end joints staggered between rows, abutting edges and ends between boards. Fill gaps exceeding 1/4 inch with insulation.
 - 1. Cut and fit insulation within 1/4 inch of nailers, projections, and penetrations.
- G. Adhered Insulation: Install each layer of insulation and adhere to substrate as follows:
 - 1. Prime surface of concrete deck with asphalt primer at rate of 3/4 gal./100 sq. ft. and allow primer to dry.
 - 2. Set each layer of insulation in a uniform coverage of full-spread insulation adhesive, firmly pressing and maintaining insulation in place.

3.4 ADHERED MEMBRANE ROOFING INSTALLATION

- A. Adhere membrane roofing over area to receive roofing and install according to membrane roofing system manufacturer's written instructions.
- B. Start installation of membrane roofing in presence of membrane roofing system manufacturer's technical personnel.
- C. Accurately align membrane roofing and maintain uniform side and end laps of minimum dimensions required by manufacturer. Stagger end laps.
- D. Bonding Adhesive: Apply to substrate and underside of membrane roofing at rate required by manufacturer and allow to partially dry before installing membrane roofing. Do not apply to splice area of membrane roofing.
- E. In addition to adhering, mechanically fasten membrane roofing securely at terminations, penetrations, and perimeter of roofing.

- F. Apply membrane roofing with side laps shingled with slope of roof deck where possible.
- G. Seams: Clean seam areas, overlap membrane roofing, and hot-air weld side and end laps of membrane roofing and sheet flashings according to manufacturer's written instructions 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 sheet membrane.
 - 2. Verify field strength of seams a minimum of twice daily and repair seam sample areas.
 - 3. Repair tears, voids, and lapped seams in roofing that does not comply with requirements.
- H. Spread sealant bed over deck drain flange at roof drains and securely seal membrane roofing in place with clamping ring.
- I. Install membrane roofing and auxiliary materials to tie in to existing roofing to maintain weathertightness of transition.

3.5 SEAM INSTALLATION

- A. Clean seam areas, overlap sheets, and weld side and end laps of sheets and flashings according to manufacturer's written instructions to ensure a watertight seam installation. Weld seam as follows:
 - 1. Weld Method: Hot air.
- B. Test lap edges with probe to verify seam weld continuity. Apply seam caulk to seal cut edges of sheet membrane.
- C. Repair tears, voids, and lapped seams in roofing that does not meet requirements.

3.6 FLASHING INSTALLATION

- A. Install sheet flashings and preformed flashing accessories and adhere to substrate according to roofing system manufacturer's written instructions.
- B. Apply bonding adhesive to substrate and underside of flashing sheet at required rate and allow to partially dry. Do not apply bonding adhesive to seam area of flashing.
- C. Flash penetrations and field-formed inside and outside corners with sheet flashing as recommended by manufacturer.
- D. Clean seam areas, overlap sheets, and firmly roll flashings into the adhesive. Weld side and end laps to ensure a watertight seam installation.
- E. Test lap edges with probe to verify seam weld continuity. Apply lap sealant and seal exposed edges of sheet flashing terminations.
- F. Terminate and seal top of sheet flashings and mechanically anchor to substrate through termination bars.

3.7 WALKWAY INSTALLATION

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

3.8 FIELD QUALITY CONTROL

- A. Verify field strength of seams a minimum of twice daily, according to manufacturer's written instructions, and repair seam sample areas.
- B. Final Roof Inspection: Arrange for roofing system manufacturer's technical personnel to inspect roofing installation on completion and submit report to Architect.
 - 1. Notify Architect or Owner 48 hours in advance of the date and time of inspection.

3.9 PROTECTING AND CLEANING

- A. Protect sheet membrane roofing from damage and wear during remainder of construction period. When remaining construction will not affect or endanger roofing, inspect roofing for deterioration and damage, describing its nature and extent in a written report, with copies to Architect and Owner.
- B. Correct deficiencies in or remove roofing that does not comply with requirements, repair substrates, reinstall roofing, and repair sheet flashings to a condition free of damage and deterioration at the time of Substantial Completion and according to warranty requirements.

3.10 WASTE MANAGEMENT

- A. Separate and dispose of waste in accordance with the Project's Waste Management Plan.

END OF SECTION

SECTION 075556 - HOT FLUID-APPLIED RUBBERIZED ASPHALT ROOFING

PART 1 - GENERAL

1.1 SUMMARY

- A. Work of this Section consists of rubberized-asphalt waterproofing membrane, and includes but is not limited to the following:
 - 1. Membrane system including accessories necessary for a complete watertight installation.
 - 2. Board insulation.
- B. Related Documents and Sections: Examine Contract Documents for requirements that directly affect or are affected by Work of this Section. A list of those Documents and Sections include, but is not limited to the following:
 - 1. Drawings and general provisions of the Contract, including General and Supplementary Conditions, and Division 01 General Requirements Specification Sections, apply to this Section.
 - 2. Section 033000 - CAST-IN-PLACE CONCRETE.
 - 3. Section 072100 - THERMAL INSULATION
 - 4. Section 076200 - SHEET METAL FLASHING AND TRIM.

1.2 SUBMITTALS

- A. Submit one complete submittal package of all required items.
- B. Product Data: Include manufacturer's written instructions for evaluating, preparing, and treating substrate, technical data, and tested physical and performance properties as may be required to show compliance with the Contract Documents.
- C. Shop Drawings: Show locations and extent of waterproofing. Include details for substrate joints and cracks, sheet flashings, penetrations, inside and outside corners, tie-ins to adjoining waterproofing, and other termination conditions. Manufacturer shall acknowledge review of shop drawings.
- D. Samples: For the following products:
 - 1. 12-by-12-inch square of flashing sheet.
 - 2. 4-by-4-inch square of drainage panel.
- E. Installer Qualifications: Submit installer's experience resume demonstrating the installer's capabilities and experience. Include lists of completed projects with project names and addresses, names and addresses of architects and owners, and other information as requested or specified. This firm must demonstrate not less than 5 years successful experience in installation of this system and work similar to the work of this project. Credentials and data must be submitted to Architect for review and approval including

contact names and numbers regarding similar products

- F. Installer Certificates: Signed by manufacturers certifying that installers comply with requirements.
- G. Product Test Reports: From a qualified independent testing agency indicating and interpreting test results of waterproofing for compliance with requirements, based on comprehensive testing of current waterproofing formulations.
- H. Certificate of Compatibility: If a curing compound is used for curing the concrete submit membrane manufacturer's certification of acceptance of the compound, concrete curing time and density as required by Article "Quality Assurance".
- I. Manufacturer's Review of Waterproofing: Before purchasing and delivering waterproofing materials to the project site, submit written statement signed by the Contractor and Installer, stating that the drawings and specifications for waterproofing work have been reviewed with a qualified representative of each of the selected manufacturers of the waterproofing materials, and that the manufacturers have not indicated any further precautions or additional requirements to be fulfilled in connection with the use of the selected materials on this project, and that the selected materials, conditions and details are not in conflict with the waterproofing manufacturer's warranty. Distribute one copy of statement to the waterproofing manufacturer.
- J. Sample Warranty: Copy of special waterproofing manufacturer's and Installer's warranty stating obligations, remedies, limitations, and exclusions before starting waterproofing.
- K. Where this material and adjacent waterproofing materials are flashed to each other, provide coordinated shop drawings clearly noting "tie-in" details and including all adjacent materials and substrates.
- L. All technical information regarding electronic leak detection system. Include any training manual / videos for owner's staff and complete list of contact names and numbers and procedures to contact electronic leak detection system provider.

1.3 QUALITY ASSURANCE

- A. Installer Qualifications: Engage an experienced Installer, recognized and approved by each of the specified waterproofing manufacturers, who has completed a minimum of three waterproofing membrane applications over the last five years which were similar in material, design, and extent to that indicated for the Project, as determined by the Architect, and which have resulted in construction with a record of successful in service performance. Provide project names, locations, completion dates, names and telephone numbers of each project's architect and owner. Include major items of waterproofing related work, including hot fluid- applied waterproofing, thermoplastic polyolefin roofing and sheet metal flashing, in the installer's scope of work for undivided responsibility for the waterproofing work.
 - 1. Employ only skilled tradesmen who are thoroughly experienced with the materials and equipment to be used in the work. The Installer shall maintain a full time supervisor/foreman (the same person for the duration of the project) who is on job site during times that waterproofing work is in progress and who is experienced in

installing waterproofing systems similar to type and scope required for this Project.

Source Limitations: Obtain waterproofing materials, sheet flashings, protection course, and drainage panels through one source from a single manufacturer. Obtain secondary products as recommended by manufacturer of primary products to use with the waterproofing system selected.

- B. Certificate of Compatibility: Refer to Division 3 Section "Cast-In-Place Concrete", for Contractors option for either moist or chemical curing of slabs and walls to receive waterproofing membranes. Chemical curing option requires certificates of compatibility by both membrane and compound manufacturer, subsequent to membrane manufacturer's review of curing compound data and samples.
- C. Manufacturer's Inspection: The Contractor shall arrange and pay for the manufacturers of the hot fluid applied waterproofing to inspect, test and report all work pertaining thereto. The Contractor shall arrange for the manufacturer's technical representatives to perform the above duties at the start up, and thereafter weekly, until the completion of the hot fluid applied waterproofing work. The Contractor shall be responsible for carrying out all recommendations of the manufacturer's technical representatives to ensure a total and complete installation of the fluid applied waterproofing work. The issuance of the Manufacturer's technical representative's final inspection reports shall be made prior to the acceptance of the waterproofing work by the Architect.
- D. Preinstallation Conference: Conduct conference at Project site to comply with requirements in Division 1 Section "Project Management and Coordination." Attendance should include but is not limited to, all contractors whose work interfaces with or is adjacent to the work of this section. Review requirements for waterproofing, including surface preparation specified under other Sections, substrate condition and pretreatment, minimum curing period, forecasted weather conditions, special details and sheet flashings, installation procedures, testing and inspection procedures, and protection and repairs. Review foreseeable methods and procedure related to waterproofing substrates, including, but not limited to, the following:
 - 1. Tour representative areas of waterproofing substrates, inspect and discuss condition of substrate, slope, drainage, membrane application, flashing details, drains, curbs, penetrations, and other preparatory work.
 - 2. Review structural loading limitations of the structural deck.
 - 3. Review required submittals, both complete and incomplete.
 - 4. Review required inspection, testing, and certification procedures.
 - 5. Review weather and forecasted weather conditions and procedures for coping with unfavorable conditions.
 - 6. Discuss waterproofing system protection requirements for construction period extending beyond waterproofing installation.

1.4 DELIVERY, STORAGE, AND HANDLING

- A. Deliver liquid materials to Project site in original containers with seals unbroken, labeled with manufacturer's name, product brand name and type, date of manufacture, and directions for storing and mixing with other components.

- B. Store liquid materials in their original undamaged containers in a clean, dry, protected location and within the temperature range required by waterproofing manufacturer.
- C. Remove and replace liquid materials that cannot be applied within their stated shelf life.
- D. Protect stored materials from direct sunlight.

1.5 PROJECT CONDITIONS

- A. Environmental Limitations: Apply waterproofing within the range of ambient and substrate temperatures recommended by waterproofing manufacturer. Do not apply waterproofing to a damp or wet substrate, or when temperature is below 0 deg F.
 - 1. Do not apply waterproofing in snow, rain, fog, or mist.
 - 2. Concrete substrates shall be completely cured and free of all moisture detrimental to the placing of waterproofing. Drying required due to wetting of substrate by inclement weather and/or adjacent wet construction shall be in accordance with waterproofing manufacturer's recommendations.
- B. Substrate: Proceed with waterproofing operations only after substrate construction and penetrating work have been completed.
 - 1. Placing of waterproofing shall constitute acceptance of substrate conditions, including curing agents, if any.
- C. Maintain adequate ventilation during application and curing of waterproofing materials.

1.6 PROTECTION

- A. Protect the building during waterproofing construction period from damage resulting from spillage, dripping and dropping of materials. Prevent waterproofing materials from entering and clogging drains and rain water conductors. Repair and restore or replace other work which is soiled or damaged in connection with the placement of the waterproofing work.
- B. Upon completion of each major area of waterproofing work, provide proper procedures for surveillance and protection of waterproofing work during the remainder of the construction period, so that the waterproofing will be without any indication of deterioration or damage at the time of acceptance by the Architect. Movement of equipment and materials without protection of waterproofing shall be cause for the Owner to stop work until protection is provided and any damage is corrected.

1.7 WARRANTY

- A. Special Manufacturer's Warranty: Written warranty, signed by waterproofing manufacturer agreeing to repair or replace waterproofing and sheet flashings that do not comply with requirements or that do not remain watertight within specified warranty period.
 - 1. Warranty does not include failure of waterproofing due to failure of substrate prepared

- and treated according to requirements or formation of new joints and cracks in substrate that exceed 1/8 inch in width.
- 2. Warranty includes removing and reinstalling protection board, drainage panels, and unit pavers.
- 3. Warranty Period: Fifteen years after date of Substantial Completion.
- B. Special Installer's Warranty: Written waterproofing Installer's warranty, signed by Installer, covering Work of this Section, for warranty period of two years.
 - 1. Warranty includes removing and reinstalling protection board, drainage panels, and unit pavers.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Products: Subject to compliance with requirements, provide one of the following products:
 - 1. American Hydrotech, Inc.; Monolithic Membrane 6125, Fabric Reinforced Assembly.
 - 2. Henry, 790-11, Fabric Reinforced System.
 - 3. CETCO, Strataseal
- B. Provide complementary products, if suggested by the manufacturer, for use under the mortar setting bed at the precast concrete stairs.

2.2 MEMBRANE

- A. Single-component; 100 percent solids; fabric reinforced hot fluid-applied, rubberized asphalt system formulated for a minimum 215 mil thick-coat application with the following properties measured per applicable test methods in CAN/CGSB-37.50:
 - 1. Flash Point: Not less than 260 deg C or not less than 25 deg C above manufacturer's maximum recommended application temperature.
 - 2. Cone Penetration: 110 maximum at 25 deg C, and 200 maximum at 50 deg C.
 - 3. Flow: 3 mm maximum at 60 deg C.
 - 4. Toughness: Not less than 5.5 J
 - 5. Ratio of Toughness to Peak Load: Not less than 0.040.
 - 6. Adhesion Rating: Pass.
 - 7. Water-Vapor Permeance: 1.7 ng/Pa x s x sq. m.
 - 8. Water Absorption: 0.35-g maximum mass gain, or 0.18-g maximum mass loss.
 - 9. Pinholing: Not more than one pinhole.
 - 10. Low-Temperature Flexibility: No cracking.
 - 11. Crack Bridging Capability: No cracking, splitting, or loss of adhesion.
 - 12. Heat Stability: Comply with requirements for penetration, flow, low-temperature flexibility, and viscosity when heated for five hours at manufacturer's recommended application temperature.

13. Viscosity Test: 2 to 15 seconds.

2.3 AUXILIARY MATERIALS

- A. Primer: ASTM D 41, asphaltic primer.
- B. Elastomeric Flashing Sheet: 60-mil minimum, nonstaining, uncured sheet neoprene with manufacturer's recommended contact adhesives and predrilled metal termination bars and anchors, with the following physical properties as measured per standard test methods referenced:
 - 1. Tensile Strength: 1400 psi minimum; ASTM D 412, Die C.
 - 2. Elongation: 300 percent minimum; ASTM D 412.
 - 3. Tear Resistance: 125 psi minimum; ASTM D 624, Die C.
 - 4. Brittleness: Does not break at minus 30 deg F; ASTM D 2137.
- C. Bonding Adhesive: Manufacturer's one-component neoprene base contact adhesive specifically recommended for applying sheet flashing to vertical surfaces.
- D. Splicing Cement: Manufacturer's synthetic rubber-base polymer adhesive specifically recommended for securing vertical laps in sheet flashing.
- E. Lap Seal: Manufacturer's EPDM or synthetic rubber sealant specifically recommended for sealing lap joints in sheet flashing.
- F. Water Block Mastic: Manufacturer's recommended mastic for bedding flashing anchors.
- G. Reinforcing Fabric: Manufacturer's recommended spun-bonded polyester fabric.
- H. Protection Course: Semi-rigid sheets of fiberglass or mineral-reinforced-asphaltic core, pressure laminated between two asphalt-saturated fibrous liners and as follows:
 - 1. Thickness: 1/4 inch, nominal.
 - 2. Facings: Provide polyethylene film facings for protection course sheets.
- I. Sheet Metal Accessories:
 - 1. Counterflashings and Reglets: Stainless steel; refer to Division 7 Section "Sheet Metal Flashing and Trim".
 - 2. Termination Bars: Type 302 or 304 stainless steel, 1/8 inch thick minimum, predrilled or punched 8 inches o.c. for mechanical fastener attachment to substrate.
 - 3. Flashing Pipe Clamping Rings: Waterproofing membrane manufacturer approved, stainless steel adjustable wormgear pipe clamping rings; size appropriate to installation

2.4 MOLDED-SHEET DRAINAGE PANELS

- A. Molded-Sheet Drainage Panel: Prefabricated, composite drainage panels, manufactured with a permeable geotextile facing laminated to a molded-plastic-sheet drainage core. The below noted materials are intended to provide for a minimum performance in concert

with overburden systems with special attention to vegetative overburden. Fully coordinate all drainage panels with vegetative overburden requirements.

1. Drainage Core: Three-dimensional, nonbiodegradable, molded-plastic-sheet material designed to effectively drain water under backfill pressure; complying with the following properties determined according to tests indicated:
 - a. Compressive Strength: 30,000 lbf/sf. ft., minimum; ASTM D 1621.
 - b. Flow Rate: 7 gpm per ft., minimum, at hydraulic gradient of 1.0 and compressive stress of 25 psi; ASTM D 4716.
2. Geotextile: Nonwoven needle-punched geotextile, manufactured for subsurface drainage, made from polyolefins or polyesters; with elongation greater than 50 percent; complying with the following properties determined according to AASHTO M 288:
 - a. Survivability: Class 2.
 - b. Apparent Opening Size: No. 70 sieve, maximum.
 - c. Permittivity: 0.1 per second, minimum.
3. Film Backing: Polymeric film bonded to drainage core surface.

2.5 PAVERS

- A. Provide pavers at areas noted, equal to Tectura pavers on manufacturer's leveling system:
 1. Pavers (RP-01): 24" x 24" precast concrete paver, standard color from the Expressions line as selected by the Architect.
 2. Stair Tread Paver (RP-02) Basis Of Design: Wausau precast stair treads, sizes as indicated, matching pavers.
- B. Colors and Finishes: As selected by the Architect from manufacturer's full range of sizes and finishes.
 1. Properties:
 - a. Compressive Strength: > 8,000 psi avg. with no individual unit less than 7,000psi, per ASTM C 140
 - b. Water Absorption: < 6% per ASTM C 140
 - c. Flexural Strength: > 800 psi. avg. per ASTM C 293
 - d. Freeze/Thaw: < 0.1 % loss of dry weight (50 Cycles) per ASTM C 1262
 - e. Center Load: 1850 lbs per WTCL 99
- C. Pedestals: Adjustable height pedestals as recommended by paver manufacturer. Provide pedestal, including screw-jack mechanism, coupler, leveler pads, shims, and integral 1/4 inch spacing tabs, of height indicated or required.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements and other conditions affecting performance.
 - 1. Verify that concrete has cured and aged for minimum time period recommended by waterproofing manufacturer.
 - 2. Verify that substrate is visibly dry and free of moisture. Test for capillary moisture by calcium chloride testing and / or relative humidity probes into concrete substrate (ASTM F2170).
 - 3. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Clean and prepare substrate according to manufacturer's written instructions. Provide clean, dust-free, and dry substrate for waterproofing application.
- B. Mask off adjoining surfaces not receiving waterproofing to prevent spillage and overspray affecting other construction.
- C. Close off deck drains and other deck penetrations to prevent spillage and migration of waterproofing fluids.
- D. Remove grease, oil, form-release agents, paints, curing compounds, and other penetrating contaminants or film-forming coatings from concrete.
 - 1. Abrasive blast clean concrete surfaces uniformly to expose top surface of fine aggregate according to ASTM D 4259 with a self-contained, re-circulating, blast-cleaning apparatus. Remove material to provide a sound surface free of laitance, glaze, efflorescence, curing compounds, concrete hardeners, or form-release agents. Remove remaining loose material and clean surfaces according to ASTM D 4258.
- E. Remove fins, ridges, and other projections and fill honeycomb, aggregate pockets, and other voids.

3.3 JOINTS, CRACKS, AND TERMINATIONS

- A. Prepare and treat substrates to receive waterproofing membrane, including joints and cracks, deck drains, corners, and penetrations according to CAN/CGSB-37.51, "Application of Rubberized Asphalt, Hot-Applied, for Roofing and Waterproofing," and waterproofing system manufacturer's written instructions.
 - 1. Rout and fill joints and cracks in substrate. Before filling, remove dust and dirt according to ASTM D 4258.
 - 2. Adhere elastomeric flashing sheet to substrate in a layer of hot, rubberized asphalt. Extend elastomeric flashing sheet a minimum of 6 inches on each side of joints and cracks and beyond deck drains, corners, and penetrations.

3. Embed reinforcing fabric into a layer of hot, rubberized asphalt. Extend reinforcing fabric a minimum of 6 inches on each side of joints and cracks, and beyond corners and penetrations.
- B. At expansion joints provide for complete integration with prefabricated expansion assemblies.

3.4 FLASHING INSTALLATION

- A. Install flashing sheets at terminations of waterproofing membrane according to CAN/CGSB-37.51, "Application of Rubberized Asphalt, Hot-Applied, for Roofing and Waterproofing," and waterproofing system manufacturer's written instructions.
- B. Prime substrate with asphalt primer.
- C. Install elastomeric flashing sheet and adhere to deck and wall substrates in a layer of hot, rubberized asphalt.
- D. Extend flashing sheet up walls or parapets a minimum of 8 inches above plaza deck pavers and 6 inches onto deck to be waterproofed. Adhere flashing to vertical surfaces by applying bonding adhesive from 3 inches above the deck to the full height of flashing. Vertical laps in flashing shall be 4 inches minimum, secured with splicing cement. Seal edge of lap seam with continuous bead of lap seal.
- E. Set metal flanges in hot fluid applied waterproofing membrane. Prime flanges of metal accessories, strip flange with specified flashing materials and tie into hot fluid applied waterproofing membrane.
- F. Extend hot fluid applied waterproofing membrane down to the flashing ring on drains, and onto concrete deck a minimum of 12 inches. Over the hot fluid applied waterproofing membrane install flashing extending a minimum distance of 6" onto the concrete deck and centered over drain flashing ring. Install drain clamping ring. Cut out center of flashing over drain bowl. Cover the flashing with hot fluid applied waterproofing membrane.
- G. Pipe Penetrations: Flash all pipes, conduits, sleeves, and other projections passing through membrane and provide tight construction throughout. Use prefabricated boots or field-fabricated boots, fitted coverings, and other accessories as required. Where pipes or conduits pass through areas to be waterproofed or where drains occur in such areas, apply hot fluid applied waterproofing membrane only after flashing around pipes, conduits and drains is in place. Lap pipe penetration flashing into the membrane. Spacing of penetrations shall be a minimum of 12" apart from each other and any angle change. Do not proceed with flashing of penetrations that do not conform to spacing requirements that allow for proper flashing with waterproofing materials.
- H. Install termination bars and mechanically fasten to top of flashing sheet at terminations and perimeter of roofing. Nail termination bars with stainless steel roofing nails at 8 inches o.c. or with other waterproofing manufacturer's approved fastening device.

3.5 MEMBRANE APPLICATION

- A. Apply rubberized asphalt according to CAN/CGSB-37.51, "Application of Rubberized

Asphalt, Hot-Applied, for Roofing and Waterproofing," and manufacturer's written instructions.

- B. Heat rubberized asphalt in an oil- or air-jacketed melter with mechanical agitator specifically designed for heating rubberized-asphalt waterproofing.
- C. Start application with manufacturer's technical representative present. As work progresses, provide the services of the manufacturer's technical representative at the job site once weekly to advise on all phases of the Work.
- D. Coordinate placement of electronic leak detection (conductive medium) system in concert with membrane system application.
- E. Apply primer, at manufacturer's recommended rate, over prepared substrate and allow to dry. Primer shall tan the surface, not blacken it.
- F. Reinforced Membrane: Apply waterproofing to substrates and adjoining surfaces indicated. Spread hot fluid-applied, rubberized asphalt to a thickness of 90 mils; embed reinforcing fabric, overlapping sheets 2 inches; and spread another 125-mil- thick layer to provide a uniform, reinforced, seamless membrane 215 mils thick.
- G. Apply waterproofing over prepared joints and up wall terminations and vertical surfaces to heights indicated or required by manufacturer.
- H. Cover waterproofing with protection course sheets while rubberized asphalt is still hot and before membrane is subject to traffic. Form a continuous protective layer for the waterproofing membrane. Butt edges tightly, stagger end joints, and cut to fit at all intersecting surfaces and penetrations.
 - 1. No waterproofing membrane shall be permitted to remain exposed at the conclusion of any working day.

3.6 MOLDED-SHEET DRAINAGE PANEL INSTALLATION

- A. Place and secure molded-sheet drainage panels to substrate according to manufacturer's written instructions. Use adhesives that do not penetrate waterproofing. Lap edges and ends of geotextile to maintain continuity. Protect installed molded-sheet drainage panels during subsequent construction.
 - 1. For vertical applications, install board insulation used as a protection course before installing drainage panels.

3.7 PAVER INSTALLATION

- A. Place pavers in concert with manufacturer recommendations, waterproofing membrane and adjacent overburden.
- B. Install pavers in compliance with requirements of ANSI-SRPI RP-4 including perimeter securement if required.

3.8 FIELD QUALITY CONTROL

- A. Field Testing by applicator:
 - 1. Perform field adhesion testing of membrane (embedded fabric with pull tab).
 - 2. Perform concrete moisture testing to include at a minimum relative humidity / moisture probe testing into concrete substrate (ASTM F2170).
- B. Water Testing: Electric Field Vector Mapping (EFVM). General contractor to allow for all costs associated with this testing.
- C. Coordinate water testing of expansion assemblies that integrate with this system.

3.9 CURING, PROTECTING, AND CLEANING

- A. Cure waterproofing according to manufacturer's written recommendations, taking care to prevent contamination and damage during application stages and curing.
 - 1. Do not permit foot or vehicular traffic on unprotected membrane.
- B. Protect waterproofing from damage and wear during remainder of construction period.
- C. Clean spillage and soiling from adjacent construction using cleaning agents and procedures recommended by manufacturer of affected construction

END OF SECTION

SECTION 076200 - SHEET METAL FLASHING AND TRIM

PART 1 - GENERAL

1.1 SUMMARY

- A. Work of this Section consists of standard and custom sheet metal flashing and trim, and includes but is not limited to the following:
 - 1. Wall flashing.
 - 2. Roof flashing.
 - 3. Underlayment materials.
- B. Related Documents and Sections: Examine Contract Documents for requirements that directly affect or are affected by Work of this Section. A list of those Documents and Sections include, but is not limited to the following:
 - 1. Drawings and general provisions of the Contract, including General and Supplementary Conditions, and Division 01 General Requirements Specification Sections, apply to this Section.
 - 2. Section 075423 - THERMOPLASTIC POLYOLEFIN ROOFING.
 - 3. Section 079200 - JOINT SEALANTS.

1.2 SUBMITTALS

- A. Product Data: For each type of product indicated. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes.
- B. Shop Drawings: Show layouts of sheet metal flashing and trim, including plans and elevations. Distinguish between shop and field-assembled Work. Include the following:
 - 1. Identify material, thickness, weight, and finish for each item and location in Project.
 - 2. Details for forming sheet metal flashing and trim, including profiles, shapes, seams, and dimensions.
 - 3. Details for fastening, joining, supporting, and anchoring sheet metal flashing and trim, including fasteners, clips, cleats, and attachments to adjoining Work.
- C. Samples: For each type of sheet metal flashing and trim indicated with factory-applied color finishes.
 - 1. Include similar Samples of trim and accessories involving color selection.

1.3 QUALITY ASSURANCE

- A. Industry Standard Requirements
 - 1. Sheet Metal Flashing and Trim Standard: Comply with SMACNA's "Architectural

Sheet Metal Manual." Conform to dimensions and profiles shown unless more stringent requirements are indicated.

PART 2 - PRODUCTS

2.1 SHEET METALS

- A. Galvalume," "Zincalume": 55% Al-Zn alloy coated steel conforming to ASTM A792 SQ Grade 40 for "Galvalume®" or "Zincalume®."
- B. Aluminum Sheet: ASTM B 209 (ASTM B 209M), 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 620. Fluoropolymer finish containing not less than 70 percent PVDF resin by weight in color coat. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.
 - 2. Color and Gloss: As selected by the Architect.
 - 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 or ASTM A666, Type 304, dead soft, fully annealed

2.2 FLASHING UNDERLAYMENT

- A. Self-Adhering, High-Temperature Sheet: 30 to 40 mils thick minimum, consisting of slip-resisting polyethylene-film top surface laminated to layer of butyl or SBS-modified asphalt adhesive, with release-paper backing; cold applied. Provide primer when recommended by underlayment manufacturer.
 - 1. Thermal Stability: Stable after testing at 240 deg F; ASTM D1970.
 - 2. Low Temperature Flexibility: Passes after testing at minus 20 deg F; ASTM D1970.

2.3 MISCELLANEOUS MATERIALS

- A. General: Provide materials and types of fasteners, solder, welding rods, protective coatings, separators, sealants, and other miscellaneous items as required for complete sheet metal flashing and trim installation.
- B. Fasteners: Wood screws, annular threaded nails, self-tapping screws, self-locking rivets and bolts, and other suitable fasteners designed to withstand design loads. Provide concealed fasteners wherever possible.
 - 1. Blind Fasteners: High-strength aluminum or stainless-steel rivets.
 - 2. Exposed Fasteners: Series 300 Stainless Steel, unless indicated otherwise.

3. Fasteners for Flashing and Trim: High domed capped gasketed fasteners

- C. Solder for Stainless Steel: ASTM B32, Grade Sn60, with acid flux of type recommended by stainless-steel sheet manufacturer.
- D. Single-Component, Nonsag, Neutral-Curing Silicone Joint Sealant: ASTM C 920, Type S, Grade NS, Class 100/50, for Use NT.
- E. Butyl Sealant: ASTM C1311, single-component, solvent-release butyl rubber sealant, polyisobutylene plasticized, heavy bodied for hooked-type expansion joints with limited movement.
- F. Bituminous Coating: Cold-applied asphalt mastic, SSPC-Paint 12, compounded for 15 mil dry film thickness per coat. Provide inert-type non-corrosive compound free of asbestos fibers, sulfur components, and other deleterious impurities.

2.4 FABRICATION, GENERAL

- A. General: Custom fabricate sheet metal flashing and trim to comply with recommendations in SMACNA's "Architectural Sheet Metal Manual" that apply to design, dimensions, metal, and other characteristics of item indicated. Shop fabricate items where practicable. Obtain field measurements for accurate fit before shop fabrication.
- B. Fabricate sheet metal flashing and trim in thickness or weight needed to comply with performance requirements, but not less than that specified for each application and metal.
- C. Fabricate sheet metal flashing and trim without excessive oil canning, buckling, and tool marks and true to line and levels indicated, with exposed edges folded back to form hems.
 - 1. Seams for Aluminum: Fabricate nonmoving seams with flat-lock seams. Form seams and seal with epoxy seam sealer. Rivet joints for additional strength.
- D. Sealed Joints: Form non-expansion but movable joints in metal to accommodate elastomeric or butyl sealant to comply with SMACNA recommendations.
- E. Expansion Provisions: Where lapped or bayonet-type expansion provisions in the Work cannot be used, form expansion joints of intermeshing hooked flanges, not less than 1 inch deep, filled with elastomeric or butyl sealant concealed within joints.
- F. Conceal fasteners and expansion provisions where possible on exposed-to-view sheet metal flashing and trim, unless otherwise indicated.
- G. Fabricate cleats and attachment devices from same material as accessory being anchored or from compatible, non-corrosive metal.
 - 1. Minimum Thickness: As recommended by SMACNA's "Architectural Sheet Metal Manual" and FMG Loss Prevention Data Sheet 1-49 for application but not less than thickness of metal being secured.

2.5 MISCELLANEOUS MATERIALS

- A. General: Provide materials and types of fasteners, solder, welding rods, protective coatings, separators, sealants, and other miscellaneous items as required for complete sheet metal flashing and trim installation and recommended by manufacturer of primary sheet metal or manufactured item unless otherwise indicated.
- B. 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.
 - b. Blind Fasteners: High-strength stainless-steel rivets suitable for metal being fastened.
 - 2. Fasteners for Stainless-Steel Sheet: Series 300 stainless steel.
- C. Solder:
 - 1. For Stainless Steel: ASTM B 32, Grade Sn60, with an acid flux of type recommended by stainless-steel sheet manufacturer.
- D. Flux:
 - 1. For Stainless Steel: acid type for pre-tinning and activated-rosin-alcohol type for soldering, or non-corrosive type such as Gregory Fabricators "Gregory 200".
- E. Sealant Tape: Pressure-sensitive, 100 percent solids, gray polyisobutylene compound sealant tape with release-paper backing. Provide permanently elastic, non-sag, nontoxic, non-staining tape 1/2 inch wide and 1/8 inch thick.
- F. Elastomeric Sealant: ASTM C 920, elastomeric silicone polymer sealant; low modulus; of type, grade, class, and use classifications required to seal joints in sheet metal flashing and trim and remain watertight.
- G. Epoxy Seam Sealer: Two-part, non-corrosive, aluminum seam-cementing compound or sealant, recommended by aluminum manufacturer for exterior non-moving joints, including aluminum riveted joints, as manufactured by Alcoa "Gutter Seal", or as approved.
- H. Bituminous Coating: Cold-applied asphalt emulsion complying with ASTM D 1187.
- I. Bituminous Paint: Fed. Spec. TT-C-494B, Type II.
- J. Asphalt Roofing Cement: ASTM D 4586, asbestos free, of consistency required for application.
- K. Mastic: Asphalt base mixture complying with ASTM D 54586, Type I.

PART 3 - EXECUTION

3.1 COORDINATION

- A. Coordinate installation of sheet metal flashing and trim with interfacing and adjoining construction to provide a leak-proof, secure, and non-corrosive installation.

3.2 INSTALLATION, GENERAL

- A. General: Anchor sheet metal flashing and trim and other components of the Work securely in place, with provisions for thermal and structural movement. Use fasteners, solder, welding rods, protective coatings, separators, sealants, and other miscellaneous items as required to complete sheet metal flashing and trim system.
 - 1. Torch cutting of sheet metal flashing and trim is not permitted.
- B. Metal Protection: Where dissimilar metals will contact each other or corrosive substrates, protect against galvanic action by painting contact surfaces with bituminous coating or by other permanent separation as recommended by fabricator or manufacturers of dissimilar metals.
- C. Install exposed sheet metal flashing and trim without excessive oil canning, buckling, and tool marks.
- D. Install sheet metal flashing and trim true to line and levels indicated. Provide uniform, neat seams with minimum exposure of solder, welds, and elastomeric or butyl sealant.
- E. Install sheet metal flashing and trim to fit substrates and to result in watertight performance. Verify shapes and dimensions of surfaces to be covered before fabricating sheet metal.
 - 1. Space cleats not more than 12 inches apart. Anchor each cleat with two fasteners. Bend tabs over fasteners.
- F. Expansion Provisions: Provide for thermal expansion of exposed flashing and trim. Space movement joints at a maximum of 10 feet with no joints allowed within 24 inches of corner or intersection.
- G. Fasteners: Use appropriate fasteners of sizes that will penetrate substrate not less than 1-1/4 inches for nails and not less than 3/4 inch for wood screws.
- H. Seal joints with elastomeric or butyl sealant as required for watertight construction.
- I. Aluminum Flashing: Rivet or weld joints in uncoated aluminum where necessary for strength.

3.3 SELF-ADHERING SHEET UNDERLAYMENT

- A. Install, wrinkle free, on roof deck. Comply with low-temperature installation restrictions of underlayment manufacturer if applicable. Install at locations indicated on Drawings, lapped in direction to shed water. Lap sides not less than 3-1/2 inches. Lap ends not

less than 6 inches staggered 24 inches between courses. Roll laps with roller. Cover underlayment within seven days.

3.4 CLEANING AND PROTECTION

- A. Clean exposed metal surfaces of substances that interfere with uniform oxidation and weathering.
- B. Clean and neutralize flux materials. Clean off excess solder and sealants.
 - 1. Do not chemically or abrasively clean plain bare copper. If necessary, construction dirt may be washed from copper with clean, fresh water only.
 - 2. Do not use soaps, detergents or other cleaning agents.
- C. 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.

3.5 WASTE MANAGEMENT

- A. Separate and dispose of waste in accordance with the Project's Waste Management Plan.

END OF SECTION

SECTION 077200 - ROOF ACCESSORIES

PART 1 - GENERAL

1.1 SUMMARY

- A. Work of this Section consists of roof accessories, and includes but is not limited to, the following:
 - 1. Roof hatch.
 - 2. Prefabricated equipment curbs.
- B. Related Documents and Sections: Examine Contract Documents for requirements that directly affect or are affected by Work of this Section. A list of those Documents and Sections include, but is not limited to the following:
 - 1. Drawings and general provisions of the Contract, including General and Supplementary Conditions and General Requirements.
 - 2. Section 075423 - THERMOPLASTIC POLYOLEFIN ROOFING.
 - 3. Section 076200 - SHEET METAL FLASHING AND TRIM.

1.2 SYSTEM DESCRIPTION

- A. Performance Requirements
 - 1. 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.

1.3 SUBMITTALS

- A. Product Data: Submit manufacturer's product data, installation instructions, use limitations and recommendations for each material used. Provide certifications stating that materials comply with requirements.
- B. Shop Drawings: For roof accessories. Include plans, elevations, keyed details, and attachments to other work. Indicate dimensions, loadings, and special conditions. Distinguish between plant- and field-assembled work.
- C. Samples: For each exposed product and for each color and texture specified, prepared on Samples of size to adequately show color.
- D. Manufacturer's Installation Instructions: Indicate special installation criteria, interface with adjacent components.
 - 1. Required clearances.

1.4 QUALITY ASSURANCE

- A. Source: For each type of product required for the work of this section, provide products of one manufacturer. Provide secondary materials which are acceptable to the manufacturers of the primary products.

1.5 DELIVERY, STORAGE AND HANDLING

- A. Deliver, store and handle materials and products in strict compliance with manufacturer's instructions and recommendations and industry standards. Protect from damage.
 - 1. Sequence deliveries to avoid delays, but minimize on-site storage.

1.6 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 non-corrosive installation.
- B. Coordinate dimensions with rough-in information or Shop Drawings of equipment to be supported.

PART 2 - PRODUCTS

2.1 ROOF HATCHES

- A. Roof Hatches: Metal roof-hatch units with lids and insulated double-walled curbs, welded or mechanically fastened and sealed corner joints, continuous lid-to-curb counterflashing and weathertight perimeter gasketing, and integrally formed deck-mounting flange at perimeter bottom.
 - 1. Basis of Design: Provide Type E-20 by Bilco Company.
 - 2. Manufacturers: Subject to compliance with requirements, other manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - a. AES Industries, Inc.
 - b. Babcock-Davis.
 - c. Dur-Red Products.
 - d. Hi Pro International, Inc.
 - e. J. L. Industries, Inc.
 - f. Acceptable equivalent.
- B. Material:
 - 1. Aluminum: Cover and frame are 11 gauge (2.3 mm) aluminum.
- C. Cover: Brakeformed, hollow-metal design with 1 in. concealed fiberglass insulation, 3 in.

beaded, overlapping flange, fully welded at corners, and internally reinforced for 40 psf live load.

- D. Curb: 12 in. in height with integral capflashing, 1 in. fiberboard insulation, fully welded at corners, and 3-1/2 in. mounting flange with 7/16 in. holes provided for securing frame to the roof deck.
- E. Gasket: Extruded EPDM rubber gasket permanently adhered to cover.
- F. Hinges: Heavy-duty pintle hinges with 3/8 in. Type 316 stainless steel hinge pins.
- G. Latch: Slam latch with interior and exterior turn handles and padlock hasps.
- H. Lift Assistance: Compression spring operators enclosed in telescopic tubes. Automatic hold-open arm with grip handle release.
- I. Finish: Mill Finish.
- J. Hardware:
 - 1. Engineered composite compression spring tubes with steel compression springs packed in grease.
 - 2. Type 316 Stainless steel hinges. All other hardware shall be zinc plated/chromate sealed.
- K. Access Ladder: Provide roof hatch access wall ladder fabricated from 6061-T6 aluminum alloy. Wall ladders shall include side rails with 1-1/8 in round rungs that are serrated and secured with cast aluminum connectors, 4 solid rivets and 3/8 in. thick brackets mounted to the walls.
 - 1. Finish: Mill.

2.2 PREFABRICATED EQUIPMENT CURBS

- 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. AES Industries, Inc.
 - 2. Curbs Plus, Inc.
 - 3. LM Curbs.
 - 4. Metallic Products Corp.
 - 5. Milcor Inc.; Commercial Products Group of Hart & Cooley, Inc.
 - 6. Roof Products, Inc.
 - 7. Thybar Corporation.
 - 8. Vent Products Co., Inc.
- B. General: Comply with loading and strength requirements as indicated where units support other work. Coordinate dimensions with rough-in information or shop drawings of equipment to be supported.

1. Fabricate of structural-quality, hot-dip galvanized or galvalume sheet steel, factory-primed and prepared for painting with welded or sealed mechanical corner joints.
2. Provide complete with cant strips and base profile coordinated with roof insulation thickness. Provide preservative-treated wood nailers at tops of curbs, coordinate with thickness of insulation and roof flashing as indicated, tapered as necessary to compensate for roof deck slopes of 1/4 inch per foot and less.
3. Unless otherwise indicated or required for strength, fabricate units of minimum 0.0747-inch thick metal, and to minimum height of 12 inches.
4. Sloping Roofs: Where slope of roof deck exceeds 1/4 inch per foot, fabricate curb/support units with height tapered to match slope to level tops of units.

C. Construction:

1. Insulation: Factory insulated with 1-1/2-inch-thick glass-fiber board insulation.
2. Liner: Same material as curb, of manufacturer's standard thickness and finish.
3. Factory-installed wood nailer at top of curb, continuous around curb perimeter.
4. On ribbed or fluted metal roofs, form deck-mounting flange at perimeter bottom to conform to roof profile.
5. Fabricate curbs to minimum height of 12 inches unless otherwise indicated.
6. Top Surface: Level around perimeter with roof slope accommodated by sloping the deck-mounting flange.

2.3 MISCELLANEOUS MATERIALS

- A. General: Provide materials and types of fasteners, protective coatings, sealants, and other miscellaneous items required by manufacturer for a complete installation.
- B. Glass-Fiber Board Insulation: ASTM C726, thickness as indicated.
- C. 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 AWPAC2; not less than 1-1/2 inches thick
- D. Bituminous Coating: Cold-applied asphalt emulsion complying with ASTM D1187.
- E. Underlayment:
 1. Felt: ASTM D226, Type II (No. 30), asphalt-saturated organic felt, non-perforated.
 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.
- F. 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 non-removable 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.
- G. 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.
- H. Elastomeric Sealant: ASTM C920, elastomeric silicone 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.
- I. Butyl Sealant: ASTM C1311, single-component, solvent-release butyl rubber sealant; polyisobutylene plasticized; heavy bodied for expansion joints with limited movement.
- J. Asphalt Roofing Cement: ASTM D4586, asbestos free, of consistency required for application.

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. General: 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, excessive oil canning, 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 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 felt underlayment and cover with a slip sheet, or install a course of polyethylene 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.

3.3 REPAIR AND CLEANING

- A. Galvanized Surfaces: Clean field welds, bolted connections, and abraded areas and repair galvanizing according to ASTM A780.
- B. Touch up factory-primed surfaces with compatible primer ready for field painting according to Section 099100 - 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.

3.4 WASTE MANAGEMENT

- A. Separate and dispose of waste in accordance with the Project's Waste Management Plan.

END OF SECTION

SECTION 078413 - PENETRATION FIRESTOPPING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Penetrations in fire-resistance-rated walls, including storefront.
2. Penetrations in horizontal assemblies, including stair anchors.

B. Related Documents and Sections: Examine Contract Documents for requirements that directly affect or are affected by Work of this Section. Other Documents and Sections that directly relate to work of this Section include, but are not limited to:

1. General provisions of the Contract, including General and Supplementary Conditions, and Division 01 General Requirements Specification Sections.
2. Section 033000 - CAST-IN-PLACE CONCRETE.
3. Section 042000 - UNIT MASONRY.
4. Section 079200 - JOINT SEALANTS.
5. Section 092900 - GYPSUM BOARD.
6. Division 22, PLUMBING.
7. Division 23, HEATING VENTILATING AND AIR CONDITIONING.
8. Division 26, ELECTRICAL.

1.2 SYSTEM DESCRIPTION

A. Firestopping shall be provided in the following locations:

1. Duct, cable, conduit, piping and their supports that penetrate through fire-rated partitions, fire walls, and exterior walls where rated. Firestopping shall be provided for all new penetrations. Locations of fire walls or partitions are indicated on the drawings.
2. Around openings and penetrations through fire-rated ceiling assemblies.
3. Other locations shown specifically on the Drawings or where called for in other sections of the specifications.

B. Performance Requirements:

1. Materials or combinations of materials used for fire stopping shall be noncombustible and comply with the following as a minimum:
 - a. Flame Spread: 25 or less, as measured by ASTM E-84
 - b. Smoke Developed: 100 or less, as measured by ASTM E-84
2. Fire stopping shall be asbestos free and shall be non-toxic to humans during installation and fire conditions

3. Examination Of Work By The Contractor

- a. It shall be the responsibility of the prime contractor to provide firestopping for the entire project. The Contractor shall examine area to receive fire stopping prior to beginning work or to submitting the data required under 1.4, Submittals.
- b. Data to be submitted shall be based on the findings of the Contractor's examination.

1.3 SUBMITTALS

A. Action Submittals:

1. Product Data: For each type of product indicated.
2. Drawings: Flashing system drawings with UL designations for each system
3. Product Schedule: For each penetration firestopping system. Include location and design designation of qualified testing and inspecting agency.

B. Informational Submittals:

1. Qualification Data: For qualified Installer.
2. Installer Certificates: From Installer indicating penetration firestopping has been installed in compliance with requirements and manufacturer's written recommendations.
3. Product Test Reports: Based on evaluation of comprehensive tests performed by a qualified testing agency, for penetration firestopping.

1.4 QUALITY ASSURANCE

A. Manufacturers Qualifications: The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by the basic designation only.

1. American Society for Testing and Materials (ASTM) Publications:
 - a. E-84 Standard Test Method for Surface Burning Characteristics of Building Materials
 - b. E119 Standard Test Method For Fire Tests of Building Construction and Materials
 - c. E814 Test Method of Fire Tests of Through-Penetration Fire stops
 - d. E1966 Fire Resistive Joint Systems
 - e. EB99 Cyclic Movement And Measuring The Min & Max Joint Widths of Arch Joint Systems
2. Underwriters Laboratories (UL) Publications:
 - a. UL-1479 Fire Tests of Through-Penetration Fire Stops
 - b. UL-2079 Tests for Fire Resistance of Building Joint Systems
 - c. FRD Fire Resistance Directory

B. Installer's Qualifications. Provide data to shown that the firm has at least two years' experience in the installation or application of systems similar in complexity to those

required for this project. In addition, provide data to show that the firm is licensed by the manufacturer and has successfully completed at least 5 comparable scale projects using the manufacturer's systems.

1. It is desirable that installers/applicators shall be UL or FM certified; installers/applicators shall, as a minimum, be manufacturer-certified to install systems selected.

C. Pre-Installation Conference

1. Conduct a pre-installation conference with all sub-contractor representatives to verify project requirements, substrate conditions, manufacturer's installation instructions, and manufacturer's warranty requirements.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Deliver products to project site in original, unopened packages with intact and legible manufacturers' labels identifying product and manufacturer, date of manufacture, and shelf life if applicable.
- B. Store materials inside, under cover, above ground, and kept dry and protected from physical damage until ready for use. Remove from site and discard wet or damaged materials.

1.6 COORDINATION

- A. Coordinate installation of all penetration firestopping systems with mechanical, electrical, fire protection, and other trades so that installation is complete and to minimize rework due to the addition of penetrants or other modifications.

1.7 WARRANTY

- A. Contractor shall warrant installation for a period of two (2) years.
- B. Warranty: Furnish two (2) year written warranty signed by the manufacturer and installer agreeing to repair or replace work which has failed as a result of defects in materials or workmanship. Upon notification within the warranty period, such defects shall be repaired at no cost to the Owner.

PART 2 - PRODUCTS

2.1 GENERAL

- A. All firestopping used throughout the project shall be the products of a single manufacturer.
- B. Manufacturers:
 1. Hilti.

2. 3M.
3. Specified Technologies, Inc.
4. Nelson.
5. Tremco.
6. General Electric.
7. International Protective Coatings Corp.
8. Thermal Ceramics.

2.2 FIRESTOPPING, GENERAL

- A. General: Use only firestopping products that have been tested for specific fire-resistance-rated construction conditions conforming to construction assembly type, penetrating item type or joint opening width and movement capabilities, annular space requirements, and fire-rating involved for each separate instance.
- B. Provide through-penetration firestop systems that are compatible with one another, with the substrates forming openings, and with the items, if any, penetrating through-penetration firestop systems, under conditions of service and application, as demonstrated by through-penetration firestop system manufacturer based on testing and field experience.
- C. Provide components for each through-penetration firestop system that are needed to install fill materials. Use only components specified by the firestopping manufacturer and approved by the qualified testing agency for the designated fire-resistance-rated systems.
- D. Fire Resistance Rating: Firestop systems shall be UL Fire Resistance listed or FM P7825a approved with "F" rating at least equal to fire-rating of fire wall or floor in which penetrated openings are to be protected, except that "F" rating may be 3 hours in through-penetrations of 4-Hour fire rated wall or floor. Firestop systems shall also have "T" rating where required.
- E. Through-Penetrations: Firestopping materials for through-penetrations shall provide "F" and "T" fire resistance ratings in accordance with ASTM E 814 or UL 1479.
- F. Construction Joints And Gaps: Construction joints and gaps shall be provided with firestopping materials and systems that have been tested per ASTM E 119, ASTM E 1966 or UL 2079 to meet the required fire resistance rating. Systems installed at construction joints shall meet the cycling requirements of ASTM E 1399 or UL 2079.

2.3 FIRESTOPPING SYSTEMS

- A. All-Weather Coatings: Moisture curing, single component silicone copolymer elastomeric spray coatings for horizontal surfaces where greater water resistance is required or inclement weather is anticipated.
- B. Cast-In-Place Firestop Device: Single component molded firestop device installed on forms prior to concrete placement with totally encapsulated, tamper-proof integral firestop system and smoke sealing gasket.

- C. Composite Sheet: Intumescent material sandwiched between a galvanized steel sheet and steel wire mesh protected with aluminum foil capable of sustaining a minimum 2,500 lbs (1,134 kg) when subjected to load testing.
- D. Elastomeric Sealants: Single component latex formulations that upon cure do not re-emulsify during exposure to moisture and accommodate minimum ± 25 percent movement.
- E. Endothermic Sealants: Single component latex formulations that upon cure do not re-emulsify during exposure to moisture,.
- F. Fire Rated Cable Pathways: Gangable device modules capable of being retrofitted around existing cables and comprised of steel raceway with intumescent foam pads allowing 0 to 100 percent cable fill and requiring no additional action in the form of plugs, twisting closure, putty, pillow, or sealant to achieve fire and leakage ratings.
- G. Fire-Rated Cable Grommet: Molded two-piece grommet made from plenum grade polymer with a foam inner core for sealing cable penetrations up to 0.53 in. (14 mm) diameter.
- H. Fire-Rated Closet Flange Gasket: Molded, single-component, intumescent gasket for use beneath a closet flange in floor applications.
- I. Fire-Rated HVAC Retaining Angles: Steel angle system with integral intumescent firestop gasket for use on steel HVAC ducts.
- J. Fire-Rated T Rating Collar Device: Louvered steel collar system with synthetic aluminized polymer coolant wrap installed on metallic pipes where T Ratings are required by applicable building code requirements.
- K. Firestop Devices: Factory-assembled steel collars lined with intumescent material capable of expanding a minimum 30 times sized to fit specific outside diameter of penetrating item.
- L. Firestop Pillows: Re-enterable, non-curing, mineral fiber core encapsulated with an intumescent coating on all six sides contained in a flame retardant poly bag.
- M. Firestop Plugs: Re-enterable, foam rubber plug impregnated with intumescent material capable of expanding minimum 10 times with expansion beginning at 350°F (177°C) for use in blank openings and cable sleeves.
- N. Firestop Putty: Intumescent, 100% solids, non-hardening, water resistant, butyl rubber based putties containing no solvents or silicone compounds.
- O. Intumescent Sealants: Single component intumescent latex formulations containing no water soluble intumescent ingredients capable of expanding a minimum 8 times.
- P. Mortar: Portland cement based dry-mix product formulated for mixing with water at Project site to form a non-shrinking, water-resistant, homogenous mortar.
- Q. Safing Insulation: Board or sheet products used as forming materials in slab-edge openings with the capacity to provide a degree of the fire resistance required when used with an appropriate fill material.

- R. Silicone Foam: Multicomponent, silicone-based liquid elastomers, that when mixed, expand and cure in place to produce a flexible, non-shrinking foam.
- S. Silicone Sealants: Moisture curing, single component, silicone elastomeric sealant for horizontal surfaces (pourable or nonsag) or vertical surface (nonsag).
- T. Wall Opening Protective Materials: Intumescent, non-curing pads or inserts for protection of electrical switch and receptacle boxes to reduce horizontal separation to less than 24" (610 mm).
- U. Wrap Strips: Single component intumescent elastomeric strips faced on both sides with a plastic film and capable of expanding a minimum 30 times.

PART 3 - EXECUTION

3.1 SURFACE PREPARATION

- A. Prior to application, remove from surfaces all dirt, grease, oil, loose materials, rust, or other substances that may affect proper fitting or required fire resistance of the fire stopping material for cast-in-place firestop devices, formwork or metal deck to receive device prior to concrete placement and shall be sound and capable of supporting device. Prepare surface as recommended by the manufacturer.

3.2 INSTALLATION

- A. Install in accordance with approved construction drawings (shop drawings), approved manufacturer's literature, installation instructions, UL Design Number or UL Report, and the following requirements:
- B. Fire stopping materials shall completely fill the void space regardless of geometric configuration, subject to tolerances established by the manufacturer when intumescent materials are used.
- C. Apply fire stopping materials at penetrations of insulated pipes and ducts, prior to application of the insulation. If insulation is already in place, remove it at the penetration prior to application of the fire stopping materials, except where intumescent materials are used and removal is not necessary per manufacturer's instructions. Removed insulation shall be replaced with a material having equal thermal insulation characteristics and equal fire stopping characteristics.
- D. Fire stopping for filling voids in floors, in which the smallest dimension is 101mm or more, shall support the same load as the floor is designed or shall be protected by a permanent barrier to prevent loading or traffic on the fire stopped area.
- E. To provide a two-hour enclosure of chases where walls or floors are penetrated by plastic drain, waste, and vent pipes, encase the pipe in an 456mm steel sleeve that penetrates the chase at a 45 degree downward angle. As an alternate, providing intumescent fire stopping systems listed for the plastic piping installation shall be acceptable.

- F. Cable tray penetrations shall be protected by either UL-listed through penetration fire stop devices or through penetration fire stop systems that are re-enterable. Where penetrating cables in a cable tray are removed, replaced, or added, restoration shall be accomplished in an approved manner; the allowable number of penetrating items shall not be exceeded; only permitted penetrations shall be installed; and adequate clearances shall be maintained among penetrations, between penetrations, and the sides of the opening.
- G. Damaged, disrupted, or removed fire stopping shall be replaced with new.
- H. Firestopping shall not be applied in conjunction with fire dampers, smoke dampers, or combination fire/smoke dampers unless specifically required by the damper manufacturer installation instructions.

3.3 INSPECTION

- A. Approved installation instructions shall be present at each work area prior to the beginning of work and a test installation shall be produced for quality check by the Architect. The test installation shall be subject to inspection and/or test for conformance with contract requirements. Periodic quality checks shall be performed at the discretion of the Architect, and should installation prove to be substandard, all fire stopping installed up to that time, not meeting approved standards, shall be replaced at no additional cost to the Owner.
- B. Area of work shall remain available for inspection by the Architect before and after application of fire stopping.
- C. Notification: Notify the Architect at least 24 hours prior to installation of fire stopping in each area to allow opportunity for inspection.
- D. The contractor shall submit written reports indicating locations of and types of penetrations and types of fire stopping used at each location; type shall be recorded by UL listed printed numbers. Contractor records shall be maintained on site and provided to the Architect upon arrival for inspections.

3.4 CLEANING AND PROTECTION

- A. At end of each workday, remove rubbish other discarded materials from Project site.
- B. Protect the work of other trades and work of this Section already installed against soiling and damage by the exercise of reasonable care and precautions. Repair or replace any work so damaged or soiled.
- C. At completion of construction activities of other trades, touch up and restore damaged or defaced coated surfaces.

3.5 WASTE MANAGEMENT

- A. Separate and dispose of waste in accordance with the Project's Waste Management Plan.

END OF SECTION

SECTION 079200 - JOINT SEALANTS

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes joint sealants, backer rod and accessories as indicated on the Drawings, implied or otherwise to create weathertight, airtight and aesthetic joints in the Work including, but not limited to:
 - 1. Joints at all penetrations.
 - 2. Brick to brick sealant, brick to metal sealant, metal to metal sealant, facade to pavement sealant.
 - 3. Interior paintable acrylic sealant
- B. Related Documents and Sections: Examine Contract Documents for requirements that directly affect or are affected by Work of this Section. Other Documents and Sections that directly relate to work of this Section include, but are not limited to:
 - 1. General provisions of the Contract, including General and Supplementary Conditions, and Division 01 General Requirements Specification Sections.
 - 2. Section 033000 - CAST IN PLACE CONCRETE.
 - 3. Section 075423 - THERMOPLASTIC POLYOLEFIN ROOFING.
 - 4. Section 076200 - SHEET METAL FLASHING AND TRIM.
 - 5. Section 078413 - PENETRATION FIRESTOPPING.
 - 6. Section 088000 - GLAZING.
 - 7. Section 092900 - GYPSUM BOARD.
 - 8. Section 093000 - TILING.

1.2 SUBMITTALS

- A. Action Submittals:
 - 1. Product Data: Submit, as needed to prove compliance with specified requirements, manufacturer's printed descriptions of materials and systems, performance criteria, use limitations, standard details, recommendations and installation information for each manufactured product.
 - 2. Samples:
 - a. Initial for Selection: Submit samples of sealant material indicating manufacturer's complete range to determine color, texture, shape, and/or composition for each type of material finish exposed to view.
 - b. Items Chosen for Final Selection: Submit products for acceptance of specifically required aesthetics.
 - 3. Sealant Schedule: Submit schedule of sealants intended for use, with description of each application location. Include joint fillers, backer rod, primers, and the like as

appropriate.

B. Informational Submittals:

1. Test Reports: Submit certified test results by a recognized testing laboratory in accordance with specified test methods for each product and/or system indicating physical, chemical and performance characteristics.
 - a. Compatibility and Adhesion Test Reports
2. Certificates: Submit with manufacturer's signature certifying that each product and/or system meets the requirements of the performance characteristics, physical criteria, and applicable standards specified.
3. Manufacturer's Instructions: Installation.
4. Qualification Statements: Submit a letter, on printed letterhead and signed by an officer of the firm, for each listed quality assurance qualification listed, attesting to meeting each requirement called out.

1.3 QUALITY ASSURANCE

A. Qualifications:

1. Manufacturer Qualifications: A firm experienced a minimum five (5) years in manufacturing products or systems similar to those indicated for this Project and with a record of successful in-service performance.
2. Installer Qualifications: Perform installation with experienced and trained Installers supervised by trained personnel who shall have at least three (3) years successful experience in installations of similar size and scope.

B. Source Limitations: Obtain joint sealants systems from a single manufacturer for each different product required to ensure compatibility.

C. Preconstruction Field-Adhesion Testing: Conduct sealant field adhesion tests to Project joint substrates prior to installation.

1.4 DELIVERY, STORAGE, AND HANDLING

A. Deliver materials and products in unopened factory labeled packages. Store and handle in strict compliance with manufacturer's instructions and recommendations. Protect from damage, moisture and direct sunlight. Sequence deliveries to avoid delays, but minimize on-site storage.

1. Manufacturers, fabricators, suppliers and shippers shall provide least amount of packaging that adequately and properly protects, supports and contains the items shipped, and is reusable, returnable or recyclable.
2. Mark products with Shop Drawing location reference, unless already properly marked.
3. Sequence deliveries to avoid delays, but minimize on-site storage.

1.5 WARRANTY

A. Warranty Requirements:

1. Special Installer's Warranty: Installer's standard form in which Installer agrees to repair or replace joint sealants that do not comply with performance and other requirements specified in this Section within specified warranty period.
 - a. Warranty Period: Two years from date of Substantial Completion.
2. Special Manufacturer's Warranty: Manufacturer's standard form in which joint-sealant manufacturer agrees to furnish joint sealants to repair or replace those that do not comply with performance and other requirements specified in this Section within specified warranty period.
 - a. Warranty Period: 10 years from date of Substantial Completion.
3. Special warranties specified in this article exclude deterioration or failure of joint sealants from the following:
 - a. Movement of the structure caused by structural settlement or errors attributable to design or construction resulting in stresses on the sealant exceeding sealant manufacturer's written specifications for sealant elongation and compression.
 - b. Disintegration of joint substrates from natural causes exceeding design specifications.
 - c. Mechanical damage caused by individuals, tools, or other outside agents.
 - d. Changes in sealant appearance caused by accumulation of dirt or other atmospheric contaminants.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Before installation check each sealant for compatibility with adjacent materials and surfaces and with indicated exposures. Select sealers which are recommended by manufacturer for each application indicated. Where exposed to pedestrian or vehicular traffic, provide sealants which are non-tracking and are strong enough to withstand the traffic without damage.
- B. Provide miscellaneous materials of type that will not bleed through sealant, discolor surface, or produce other deleterious effects. Select size to provide compression to approximately 2/3 original width when in place. Provide backing material profile concave to the rear of the sealant, and equipped with a bond-breaking film.

2.2 ELASTOMERIC JOINT SEALANTS

- A. Elastomeric Sealants: Comply with ASTM C920 and other requirements indicated for each liquid-applied chemically curing sealant specified, including those referencing ASTM C920 classifications for type, grade, class, and uses related to exposure and joint substrates.
- B. Stain-Test-Response Characteristics: Where elastomeric sealants are specified to be non-staining to porous substrates, provide products that have undergone testing

according to ASTM C1248 and have not stained porous joint substrates indicated for Project.

- C. Silicone sealants: Neutral-cure silicone sealant meeting ASTM C920, Type S, Grade NS (Non-sag), Class 25.
 - 1. Medium Modulus (Joint movement capability 50% extension and compression):
 - a. DOW Corning 795.
 - b. Pecora 864.
 - c. Tremco Spectrem 2.
 - 2. Low Modulus (Joint movement capability 100% extension and 50% compression):
 - a. DOW Corning 790.
 - b. Pecora 890.
 - c. Tremco Spectrem 1.

2.3 POLYURETHANE SEALANTS

- A. Self-Leveling Polyurethane Sealant: Provide two or more part, self-leveling, polyurethane based elastomeric sealant, complying with ASTM C 920, Fed. Spec. TT-S-00227E Type 1 Class A, having Shore A hardness of not less than 30 when tested according to ASTM C 920, cured modulus of elasticity at 100% elongation of not more than 150 psi when tested according to ASTM D 412, and tear resistance of not less than 50 lbs./inch when tested according to ASTM D 624.
 - 1. Where joint surfaces contain bituminous materials, provide modified sealants which are compatible with bituminous materials encountered.
 - 2. Provide one of the following products, or acceptable equivalent, that meets or exceed specified requirements:
 - a. Pecora Urexpan NR-200.
 - b. Mameco Vulkem 245 or 255.
 - c. Sika 2C, SL.
 - d. Sonneborn Sonolastic PvJtSt.
 - e. Tremco THC 900.
 - 3. Extent: Provide self-leveling polyurethane sealant for joint between facade and exterior paving joint and at paving joints not indicated to be sealed with another type of sealant.
- B. Non-Sag Polyurethane Sealant: Provide multi-part, non-sag, polyurethane based elastomeric sealant, complying with ASTM C 920 Type M, Grade NS, Class 25, Fed. Spec. TT-S-00227E Class A, having Shore A hardness of 20 to 30, cured modulus of elasticity at 100% elongation of not more than 75 psi, and tear resistance of not less than 50 lbs./inch when tested according to ASTM D 624.
 - 1. Provide one of the following products, or acceptable equivalent, that meets or exceed specified requirements:
 - a. Mameco International Vulkem 227
 - b. Harry S. Peterson Co. Iso-Flex 2000

- c. Sika Sikaflex 2c NS.
 - d. Sonneborn Sonolastic NP 2.
 - e. Tremco Dymeric
2. Extent: Provide non-sag polyurethane sealant at locations indicated.

2.4 SEALANT FOR WATER IMMERSION

- A. Provide multi-part based polysulfide sealant, complying with ASTM C 719 Type M, Grade NS, Class 12-1/2, with a history of field experience in sealing joints immersed intermittently or continuously in water of same composition as that to which sealant will be exposed after installation, conforming to Pecora "Dynatred", or approved equal.
- B. Extent: Provide sealant for water immersion at joints located in fountain/pools.

2.5 PREFORMED JOINT SEALER

- A. Preformed Resilient Joint Sealer: Preformed Resilient Joint Sealer for use at expansion joints in exterior concrete and masonry walls where specifically called for on Drawings shall be preformed, resilient, extruded polychlorophrene elastomeric joint sealer, conforming to ASTM D 2628 and AASHTO M 220 of indicated configuration(s), in continuous lengths, set in manufacturer's recommended primer-lubricating-adhesive consisting of moisture curing polyurethane and aromatic hydrocarbon solvent mixture (73% solid by weight) concrete gray color, equal to one of the following:
 - 1. D.S. Brown Co.
 - 2. Watson-Bowman & Acme Corp.

2.6 PREFORMED, PRECOMPRESSED, IMPREGNATED FOAM SEALANT

- A. Provide manufacturer's standard preformed, precompressed, impregnated open-cell foam sealant manufactured from high-density urethane foam impregnated with a nondrying, water-repellant agent; factory-produced in precompressed sizes in roll or stick form to fit joint widths indicated. Provide foam sealant permanently elastic, mildew-resistant, nonmigratory, nonstaining, compatible with substrates, and complying with the following requirements:
 - 1. Impregnating Agent: Manufacturer's standard.
 - 2. Density: 8 - 10 lb./cu. ft.
 - 3. Backing: Manufacturer's standard pressure sensitive adhesive, factory applied to one side, with protective wrapping.
- B. Provide one of the following products, or acceptable equivalent, that meets or exceeds specified requirements:
 - 1. Emseal Greyflex; Emseal Corp.
 - 2. Will-Seal 150; Wil-Seal Construction Foams Div., Illbruck.
 - 3. York-Seal 100; York Manufacturing, Inc.

2.7 ACRYLIC SEALANTS

- A. Acrylic Sealant for Exposed and Concealed Joints: Non-sag, paintable, non-staining latex sealant complying with ASTM C834 and the following:
 - 1. Product effectively reduces airborne sound transmission through perimeter joints and openings in building construction as demonstrated by testing representative assemblies according to ASTM E90.

2.8 ACCESSORIES

- A. Joint Cleaner: Cleaner as recommended by sealant manufacturer for substrates indicated.
- B. Joint Primer: As recommended by sealant manufacturer for substrates, conditions and exposures indicated.
- C. Joint Sealant Backing
 - 1. Provide sealant backings of material that are nonstaining; are compatible with joint substrates, sealants, primers, and other joint fillers; and are approved for applications indicated by sealant manufacturer based on field experience and laboratory testing.
 - a. Cylindrical Sealant Backings: ASTM C 1330, Type C, O, B, 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.
- D. Bond Breaker: Polyethylene tape or other adhesive faced tape as recommended by sealant manufacturer to prevent sealant contact where it would be detrimental to sealant performance.
- E. Masking Tape: Non-staining, non-absorbent tape product compatible with joint sealants and adjacent joint surfaces that is suitable for masking.

PART 3 - EXECUTION

3.1 PROJECT CONDITIONS

- A. Compatibility:
 - 1. Determine compatibility characteristics of sealants in contact with sealant backings Determine compatibility characteristics of sealants in contact with sealant backings by Test Method ASTM C1087.
 - 2. Provide joint sealants, joint fillers and accessory joint materials that are compatible with one another and with joint substrates under project conditions.
 - 3. Install joint sealants, joint fillers and related joint materials that are non-staining to visible joint surfaces and surrounding substrate surfaces.
- B. Scheduling:

1. Schedule applications of waterproofing, water repellents and preservative finishes after sealant installation unless sealant manufacturer approves otherwise in writing.
2. Ensure that installed sealant is allowed to cure sufficiently prior to subsequent applications.

3.2 EXAMINATION

- A. Carefully examine areas with Installer present, for compliance with requirements affecting Work performance.
 1. Verification of Conditions: Verify that field measurements, surfaces, substrates, structural support, utility connections, tolerances, levelness, plumbness, humidity, moisture content level, cleanliness and other conditions are as required by the manufacturer, and ready to receive Work.
 - a. Consult with sealant manufacturers to determine whether priming is necessary.
 - b. Provide joints properly dimensioned to receive the approved sealant system.
 - c. Provide joint surfaces that are clean, dry, sound and free of voids, deformations, protrusions and contaminants that may inhibit application or performance of the joint sealant.
 - d. Test substrate as needed to verify proper conditions.
 2. Proceed with installation only after unsatisfactory conditions have been corrected.

3.3 PREPARATION

- A. Climatic Placement Requirements, as recommended by manufacturers to install products.
 1. Set Conditioned Temperature and Humidity.
 2. Provide Temporary Heating.
 3. Provide Ventilation.
- B. Substrate Preparation in accordance with manufacturer's instructions.
- C. Product Handling in accordance with manufacturer's instructions.
 1. Remove shipping / storage protection.
 2. Acclimatize product to installation location.
 3. Strictly adhere to manufacturer's handling and installation safety requirements.

3.4 ENVIRONMENTAL PROCEDURES

- A. Comply, at minimum, with sealant and sealant primer manufacturer recommendations for space ventilation during and after installation. Where feasible, the following ventilation conditions shall be maintained during the sealant/sealant primer curing period or for 72 hours after installation.
- B. To the extent practical, allow sealant and sealant primer installations to cure prior to the installation of materials that adsorb VOCs. Materials that adsorb VOCs include carpets,

textiles, unprimed GWB, and acoustical ceiling panels.

3.5 INSTALLATION

- A. Install in complete accordance with the manufacturer's written instructions, and per ASTM C1193, except where more stringent requirements are indicated or specified.
- B. Provide the approved sealant system where shown on the Drawings, and in strict accord with the manufacturer's recommendations as approved by the Architect.
- C. Install sealants immediately after joint preparation.
- D. Mix and apply multi-component sealants in accord with manufacturer's printed instructions.
- E. Install sealants to fill joints completely from the back, without voids or entrapped air, using proven techniques, proper nozzles and sufficient force that result in sealants directly contacting and fully wetting joint surfaces.
- F. Install sealants to uniform cross-sectional shapes with depths relative to joint widths that allow optimum sealant movement capability as recommended by sealant manufacturer.
- G. Tool sealants in manner that forces sealant against back of joint, ensures firm, full contact at joint interfaces and leaves a finish that is smooth, uniform and free of ridges, wrinkles, sags, air pockets and embedded impurities.
 - 1. Dry tooling is preferred; tooling liquids that are non-staining, non-damaging to adjacent surfaces and approved by sealant manufacturer may be used if necessary when care is taken to ensure that the liquid does not contact joint surfaces before the sealant.
 - 2. Provide concave tooled joints unless otherwise indicated to provide flush tooling or recessed tooling.
 - 3. Provide recessed tooled joints where the outer face of substrate is irregular.
- H. Remove sealant from adjacent surfaces in accord with sealant and substrate manufacturer recommendations as work progresses.
- I. Protect joint sealants from contact with contaminating substances and from damages. Cut out, remove and replace contaminated or damaged sealants, immediately, so that they are without contamination or damage at time of Substantial Completion.
- J. Acoustical Sealants:
 - 1. Acoustical sealant shall be applied in continuous beads. The material shall be resilient and non-setting.
 - 2. Seal sound-rated partitions on both sides where facings abut dissimilar materials. Fill void with 1/4 inch minimum to 3/8 inch maximum round bead of sealant, as required.
 - 3. Seal at the following locations:
 - a. Around the perimeter, in the angle formed by panels and abutting dissimilar materials.

- b. At all intersections, and all penetrations of floor, ceiling, walls, columns.
- c. At all panel terminations in door and window frames, and at control joint to panels.
- d. Around all cutouts for lights, cabinets, pipes, plumbing, HVAC ducts, electrical boxes, etc.
- e. And at other locations as required on detail drawings or in written specifications.

3.6 FIELD QUALITY CONTROL

- A. Manufacturers' Field Services: Manufacturer's field representative to inspect and approve of installation prior to issuing warranty.

3.7 CLEANING AND PROTECTION

- A. At end of each workday, remove rubbish other discarded materials from Project site.
- B. Protect the work of other trades and work of this Section already installed against soiling and damage by the exercise of reasonable care and precautions. Repair or replace any work so damaged or soiled.
- C. At completion of construction activities of other trades, touch up and restore damaged or defaced coated surfaces.

3.8 WASTE MANAGEMENT

- A. Separate and dispose of waste in accordance with the Project's Waste Management Plan.

END OF SECTION

SECTION 081113 - HOLLOW METAL DOORS AND FRAMES

PART 1 - GENERAL

1.1 SUMMARY

- A. Work of this Section consists of interior and exterior-type hollow metal doors and frames.
- B. Related Documents and Sections: Examine Contract Documents for requirements that directly affect or are affected by Work of this Section. Other Documents and Sections that directly relate to work of this Section include, but are not limited to:
 - 1. General provisions of the Contract, including General and Supplementary Conditions, and Division 01 General Requirements Specification Sections.
 - 2. Section 042000 - UNIT MASONRY.
 - 3. Section 055000 - METAL FABRICATIONS.
 - 4. Section 087100 - DOOR HARDWARE.
 - 5. Section 088000 - GLAZING.
 - 6. Section 092900 - GYPSUM BOARD.
 - 7. Section 099100 - PAINTING.

1.2 SUBMITTALS

- A. Action Submittals:
 - 1. Product Data: For each type of product indicated. Include construction details, material descriptions, core descriptions, fire-resistance rating, temperature-rise ratings and finishes.
 - a. Refer to Door and Frame Schedule on Drawing for fire rating requirements. Particular attention shall be paid to the requirements for unit door and frame assemblies.
 - 2. Shop Drawings: Indicate door and frame elevations, dimensions, fire rating, door reveals, door type, core, reinforcement, finish, hardware locations, cutout locations, frame profiles, details, metal gauge, anchorage details, and finish.
 - 3. Schedule: Schedule of doors and frames, using same reference numbers for details and openings as those on Drawings. Indicate frame and door types.
- B. Informational Submittals:
 - 1. Manufacturer's Statement: Provide manufacturer's statement confirming that doors can be used for electrical closet applications with proprietary hardware at those locations.
 - 2. Quality Assurance Submittals:
 - a. Test Reports: Based on evaluation of comprehensive tests performed by a

qualified testing agency, for each type of hollow metal door and frame assembly.

- b. Certificates: Submit with manufacturer's signature certifying that each product and/or system meets the requirements of the performance characteristics, physical criteria, and applicable standards specified.
 - 1). Certification of performance for sound rated doors.
- c. Manufacturer's Instructions: Installation.
- d. Qualification Statements: Submit a letter, on printed letterhead and signed by an officer of the firm, for each listed quality assurance qualification listed, attesting to meeting each requirement called out.
 - 1). Qualification statements; AHC certificate

1.3 QUALITY ASSURANCE

A. Qualifications:

- 1. Manufacturer Qualifications: A firm experienced a minimum five (5) years in manufacturing products or systems similar to those indicated for this Project and with a record of successful in-service performance.
- 2. Installer Qualifications: Perform installation with skilled, experienced and trained workmen supervised by trained personnel who shall have at least three (3) years successful experience in installations of similar size and scope.

B. Comply with HMMA 840 and 861.

C. Regulatory Requirements:

- 1. Fire Labeled Doors and Frames: Comply with the following:
 - a. Fire-Rated Assemblies: Complying with NFPA 80 and listed and labeled by a qualified testing agency acceptable to authorities having jurisdiction for fire-protection ratings and temperature-rise limits indicated, based on testing at positive pressure according to NFPA 252 or UL 10C.
 - b. Smoke- and Draft-Control Assemblies: Provide an assembly with gaskets listed and labeled for smoke and draft control by a qualified testing agency acceptable to authorities having jurisdiction, based on testing according to UL 1784 and installed in compliance with NFPA 105.
- 2. Fire-Rated, Borrowed-Light Assemblies: Complying with NFPA 80 and listed and labeled by a testing and inspecting agency acceptable to authorities having jurisdiction for fire-protection ratings indicated, based on testing according to NFPA 257.

D. Source Limitations: Obtain doors and frames through one source from a single manufacturer.

E. Pre-installation Meeting: Purpose is to review installation procedures and warranty requirements.

- 1. Attendees: Architect, Contractor, Installer.

1.4 DELIVERY, STORAGE, AND HANDLING

- A. Deliver hollow metal work palletized and strippable film wrapped to provide protection during transit and Project-site storage. Do not use non-vented plastic.
- B. Deliver welded frames with two removable spreader bars across bottom of frames, tack welded to jambs and mullions.
- C. Store hollow metal work under cover at Project site. Place in stacks of five units maximum in a vertical position with heads up, spaced by blocking, on minimum 4-inch-high wood blocking. Do not store in a manner that traps excess humidity.
 - 1. Provide minimum 1/4-inch space between each stacked door to permit air circulation.

1.5 COORDINATION

- A. Coordinate installation of anchorages 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.

1.6 WARRANTY

- A. Contractor shall warrant installation for a period of two (2) years.
- B. Warranty: Furnish two (2) year written warranty signed by the manufacturer and installer agreeing to repair or replace work which has failed as a result of defects in materials or workmanship. Upon notification within the warranty period, such defects shall be repaired at no cost to the Owner.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Manufacturers. Subject to requirements provide products from the following, or an Architect acceptable equivalent:
 - 1. Ceco Doors.
 - 2. Curries Company.
 - 3. Steelcraft.
 - 4. Republic.
 - 5. Kewanee.
 - 6. Pioneer.

2.2 MATERIALS

- A. Hot-rolled Steel: ASTM A568 and ASTM A569, commercial quality, pickled and oiled.

- B. Cold-rolled Steel: ASTM A366 or ASTM A568, commercial quality carbon steel.
- C. Metallic-Coated Steel Sheet: ASTM A653/A653M, Commercial Steel (CS), Type B; with minimum G60 (Z180) or A60 (ZF180) metallic coating.
- D. Anchors and Fasteners: Manufacturer's standard units fabricated from not less than 18 gauge galvanized sheet steel or 18 gauge hot-dip galvanized steel complying with ASTM A153, class C or D.
- E. Core fill for fire-rated doors: 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.

2.3 FABRICATION

- A. General Requirements: Fabricate work to be truly rigid, straight, plumb, level and square. Provide work matching sizes, shapes, and profiles indicated on approved shop drawings.
- B. Concealed Components: Fabricate concealed components in doors and frames from either hot or cold rolled steel.
- C. Hardware Preparation: Fabricate frames to receive mortised and concealed finish hardware as indicated on approved final hardware schedules. Comply with applicable provisions of ANSI A115 series specifications for hardware preparation.
- D. Hardware Locations: Locate hardware as indicated on final hardware shop drawings or, if not shown, as indicated in Recommended Locations for Builder's Hardware, published by Door and Hardware Institute.
- E. Bituminous Coating: Cold-applied asphalt mastic, SSPC-Paint 12, compounded for 15-mil dry film thickness per coat. Provide inert-type non-corrosive compound free of asbestos fibers, sulfur components, and other deleterious impurities.

2.4 INTERIOR HOLLOW METAL 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. Commercial Doors and Frames: NAAMM-HMMA 867. At locations indicated in the Door and Frame Schedule.
 - 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.
 - c. Face: Uncoated, cold-rolled steel sheet, minimum thickness of 0.042 inch.
 - d. Edge Construction: Continuously welded with no visible seam.

- e. Core: Steel stiffened.
 - 3. Frames:
 - a. Materials: Uncoated steel sheet, minimum thickness of 0.053 inch for door openings 48 inches or less, or window frames; minimum thickness of 0.067 inch for door openings greater than 48 inches. Provide thicker frames and/or jamb reinforcement at high span conditions.
 - b. Construction: Face welded.
 - C. Sidelite and Borrowed Lite Frames:
 - 1. Construct as specified for door frames. Where required, provide concealed field-applied mullion clips for securing mullions to head/jamb members.
 - 2. Form fixed glazing stops integral with frame members.
 - 3. Provide removable metal stops with pre-punched screw holes complete with installation screws.
 - D. Factory Finishing
 - 1. Prime finished, suitable for field applied finish paint in the standard grey prime color.
 - 2. Coordinate painting of exterior doors to receive high performance coating with the work of Section 099600.
- 2.5 EXTERIOR HOLLOW METAL DOORS AND FRAMES:
- A. Extra-Heavy-Duty Doors and Frames: SDI A250.8, Level 3.
 - 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
 - c. Face: Metallic-coated steel sheet, minimum thickness of 0.053 inch, with minimum G60 A60 coating.
 - d. Edge Construction: Interlocking with visible seam.
 - e. Core: Polyisocyanurate, Polystyrene, or Polyurethane as required to achieve specified thermal insulation value.
 - 1). Provide exterior doors fabricated with thermal-resistance value (R-value) of not less than 6 deg F x h x sq. ft./Btu when tested according to ASTM C 1363.
 - 3. Frames:
 - a. Materials: Metallic-coated steel sheet, minimum thickness of 0.053 inch, with minimum G60 coating; minimum thickness of 0.067 inch for door openings greater than 48 inches. Provide thicker frames and/or jamb reinforcement at high span conditions.
 - b. Construction: Face welded.
 - B. Factory Finishing

1. Prime finished, suitable for field applied finish paint in the standard grey prime color.

2.6 ACCESSORIES

A. Frame Accessories:

1. Dust/Mortar box at strike location on drywall frames.
2. Shipping bars on welded frames.
3. Door Silencers: Except on weather-stripped or rated doors, 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.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Carefully examine installation areas with Installer present, for compliance with requirements affecting Work performance.
 1. Verification of Conditions: Verify that field measurements, surfaces, substrates, structural support, utility connections, tolerances, levelness, plumbness, humidity, moisture content level, cleanliness and other conditions are as required by the manufacturer, and ready to receive Work.
 - a. Inspect rough openings to detect problems that would prevent the proper installation of doors and frames, and correct.
 - 1). Rough openings shall be square, level and plumb with accurate dimensions.
 2. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Prepare substrate(s) in accordance with manufacturer's instructions, which may include the following:
 1. Clean surfaces.
 2. Level exposed and shim hidden substrate surfaces as needed.
 3. Coat substrate when necessary to protect from galvanic action, separating dissimilar metal materials.
 4. Install framing, blocking or other necessary structural reinforcement.
- B. Handle products in accordance with manufacturer's instructions and warranty requirement including, but not limited to:
 1. Remove shipping / storage protection:
 - a. Remove shipping bars on welded frames before installation and verify frame dimensions.

2. Strictly adhering to manufacturer's handling and installation safety requirements.

3.3 INSTALLATION

- A. Install frames plumb, level, rigid, and in true alignment in accordance with ANSI A250.11 and DHI A115.1G.
 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-protection-rated openings, install frames according to NFPA 80.
 - b. Where frames are fabricated in sections because of shipping or handling limitations, field splice at approved locations by welding face joint continuously; grind, fill, dress, and make splice smooth, flush, and invisible on exposed faces.
 - c. Install frames with removable glazing stops located on secure side of opening.
 - d. Install door silencers in frames before grouting.
 - e. Remove temporary braces necessary for installation only after frames have been properly set and secured.
 - f. Check plumbness, squareness, and twist of frames as walls are constructed. Shim as necessary to comply with installation tolerances.
 - g. Field apply bituminous coating to backs of frames that are filled with grout containing antifreezing agents.
 2. Floor Anchors: Provide floor anchors for each jamb and mullion that extends to floor, and secure with post-installed expansion anchors.
 - a. Floor anchors may be set with powder-actuated fasteners instead of post-installed expansion anchors if so indicated and approved on Shop Drawings.
 3. Metal-Stud Partitions: Solidly pack mineral-fiber insulation behind frames.
 4. Masonry Walls: Coordinate installation of frames to allow for solidly filling space between frames and masonry with grout.
 5. In-Place Concrete or Masonry Construction: Secure frames in place with post-installed expansion anchors. Countersink anchors, and fill and make smooth, flush, and invisible on exposed faces.
 6. In-Place Gypsum Board Partitions: Secure frames in place with post-installed expansion anchors through floor anchors at each jamb. Countersink anchors, and fill and make smooth, flush, and invisible on exposed faces.
 7. Ceiling Struts: Extend struts vertically from top of frame at each jamb to overhead structural supports or substrates above frame unless frame is anchored to masonry or to other structural support at each jamb. Bend top of struts to provide flush contact for securing to supporting construction. Provide adjustable wedged or bolted anchorage to frame jamb members.
 8. 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, measured at door rabbet on a line 90 degrees from jamb perpendicular to frame head.
 - b. Alignment: Plus or minus 1/16 inch, measured at jambs on a horizontal line parallel to plane of wall.

- c. Twist: Plus or minus 1/16 inch, measured at opposite face corners of jambs on parallel lines, and perpendicular to plane of wall.
 - d. Plumbness: Plus or minus 1/16 inch, measured at jambs at floor.
- B. Doors shall be installed and fastened to maintain alignment with frames to achieve maximum operational effectiveness and appearance. Doors shall be adjusted to maintain perimeter clearances specified. Shimming shall be performed by the installer as needed to assure the proper clearances are achieved.
 - 1. Non-Fire-Rated Standard Steel Doors:
 - a. Jambs and Head: 1/8 inch plus or minus 1/16 inch.
 - b. Between Edges of Pairs of Doors: 1/8 inch plus or minus 1/16 inch.
 - c. Between Bottom of Door and Top of Threshold: Maximum 3/8 inch.
 - d. Between Bottom of Door and Top of Finish Floor (No Threshold): Maximum 3/4 inch.
 - 2. Fire-Rated Doors: Install doors with clearances according to NFPA 80.
 - 3. Smoke-Control Doors: Install doors according to NFPA 105.

3.4 CLEANING AND PROTECTION

- A. At end of each workday, remove rubbish other discarded materials from Project site.
- B. Protect the work of other trades and work of this Section already installed against soiling and damage by the exercise of reasonable care and precautions. Repair or replace any work so damaged or soiled.
- C. At completion of construction activities of other trades, touch up and restore damaged or defaced coated surfaces.

3.5 WASTE MANAGEMENT

- A. Separate and dispose of waste in accordance with the Project's Waste Management Plan.

END OF Section

SECTION 083113 - ACCESS DOORS AND FRAMES

PART 1 - GENERAL

1.1 SUMMARY

- A. Work of this Section consists of access doors and frames.
- B. Scope: Access doors specified herein shall be provided for building system components including but not limited to the following wherever they would otherwise be inaccessible:
 - 1. Shutoff and balancing valves, fire dampers, points of duct access, pull boxes, controls of mechanical and electrical items, masonry shafts for pipes and conduits, pipe spaces, fan inlets, fusible links, automatic dampers and motors.
- C. Related Documents and Sections: Examine Contract Documents for requirements that directly affect or are affected by Work of this Section. Other Documents and Sections that directly relate to work of this Section include, but are not limited to:
 - 1. General provisions of the Contract, including General and Supplementary Conditions, and Division 01 General Requirements Specification Sections.
 - 2. Section 087100 - DOOR HARDWARE.
 - 3. Section 092900 - GYPSUM BOARD.

1.2 SUBMITTALS

- A. Action Submittals:
 - 1. Product Data: For each type of access door and frame indicated. Include construction details, fire ratings, materials, individual components and profiles, and finishes.
 - 2. Shop Drawings: Show fabrication and installation details of access doors and frames for each type of substrate. Include plans, elevations, sections, details, and attachments to other work.
 - a. Submit required locations prior to start of construction to show careful coordination with reflected ceiling plans and tile layout.
 - 3. Samples: For each door face material, at least 3 by 5 inches in size, in specified finish.
 - 4. Access Door and Frame Schedule: Provide complete access door and frame schedule, including types, locations, sizes, latching or locking provisions, and other data pertinent to installation.
 - 5. Ceiling Coordination Drawings: Reflected ceiling plans, drawn to scale, on which ceiling-mounted items including access doors and frames, lighting fixtures, diffusers, grilles, speakers, sprinklers, and special trim are shown and coordinated with each other.
- B. Informational Submittals:

1. Quality Assurance Submittals:

- a. Test Reports: Submit certified test results by a recognized testing laboratory in accordance with specified test methods for each product and/or system indicating physical, chemical and performance characteristics.
- b. Certificates: Submit with manufacturer's signature certifying that each product and/or system meets the requirements of the performance characteristics, physical criteria, and applicable standards specified.
- c. Manufacturer's Instructions: Installation.
- d. Qualification Statements: Submit a letter, on printed letterhead and signed by an officer of the firm, for each listed quality assurance qualification listed, attesting to meeting each requirement called out.
- e. Manufacturer's Field Reports.

1.3 QUALITY ASSURANCE

A. Qualifications:

1. Manufacturer Qualifications: A firm experienced a minimum five (5) years in manufacturing products or systems similar to those indicated for this Project and with a record of successful in-service performance.
2. Installer Qualifications: Perform installation with skilled, experienced and trained workmen supervised by trained personnel who shall have at least three (3) years successful experience in installations of similar size and scope.

B. Regulatory Requirements:

1. Fire-Rated Access Doors and Frames: Units complying with NFPA 80 that are identical to access door and frame assemblies tested for fire-test-response characteristics per the following test method and that are listed and labeled by UL or another testing and inspecting agency acceptable to authorities having jurisdiction:
 - a. NFPA 252 or UL 10B for vertical access doors and frames.
 - b. ASTM E119 or UL 263 for horizontal access doors and frames.

C. Size Variations: Obtain Architect's acceptance of manufacturer's standard-size units, which may vary slightly from sizes indicated.

D. Source Limitations: Obtain each type of access door(s) and frame(s) through one source from a single manufacturer.

E. Pre-installation Meeting: Purpose is to review installation procedures and warranty requirements.

1. Attendees: Architect, Contractor, Installer.
2. Agenda/

1.4 DELIVERY, STORAGE, AND HANDLING

- A. Storage and Handling: Strictly comply with Steel Door Institute recommendations. Protect from all possible damage.

1. Delivery Sequence: Avoid project delays, but minimize on-site storage:

1.5 WARRANTY

- A. Contractor shall warrant installation for a period of two (2) years.
- B. Warranty: Furnish five (5) year written warranty signed by the manufacturer and installer agreeing to repair or replace work which has failed as a result of defects in materials or workmanship. Upon notification within the warranty period, such defects shall be repaired at no cost to the Owner.

PART 2 - PRODUCTS

2.1 ACCESS DOORS AND FRAMES

- A. Manufacturers - Access Doors:
 1. Karp Associates, Inc.
 2. Milcor., Inc.
 3. Nystrom, Inc.
 4. Architect acceptable equivalent.

2.2 MATERIALS

- A. Steel Sheet: Uncoated or electrolytic zinc-coated, ASTM A591 / A591M with cold-rolled steel sheet substrate complying with ASTM A1008 / A1008M, Commercial Steel (CS), exposed.
- B. Drywall Beads: Edge trim formed from 0.0299 inch zinc-coated steel sheet formed to receive joint compound and in size to suit thickness of gypsum board.

2.3 FABRICATION - GENERAL

- A. General: Provide access door and frame assemblies manufactured as integral units ready for installation.
- B. Metal Surfaces: For metal surfaces exposed to view in the completed Work, provide materials with smooth, flat surfaces without blemishes. Do not use materials with exposed pitting, seam marks, roller marks, rolled trade names, or roughness.
- C. Doors and Frames: Grind exposed welds smooth and flush with adjacent surfaces. Furnish attachment devices and fasteners of type required to secure access panels to types of supports indicated.
 1. For trimless frames with drywall bead, provide edge trim for gypsum board and gypsum base securely attached to perimeter of frames.
 2. For trimless frames with plaster bead for full-bed plaster applications, provide zinc-coated expanded metal lath and exposed casing bead welded to perimeter of

- frames.
- 3. Provide mounting holes in frames for attachment of units to metal or wood framing.
- 4. Provide mounting holes in frame for attachment of masonry anchors. Furnish adjustable metal masonry anchors.
- D. Latching Mechanisms: Furnish number required to hold doors in flush, smooth plane when closed.
- E. Fire-Rated, Insulated, Flush Access Doors and Frames: Fabricated from steel sheet.
 - 1. Locations: Wall and ceiling surfaces, including shaftwall construction.
 - 2. Fire-Resistance Rating: Not less than that of adjacent construction.
 - 3. Temperature Rise Rating: 250 deg F at the end of 30 minutes.
 - 4. Door: Flush panel with a core of mineral-fiber insulation enclosed in sheet metal with a minimum thickness of 0.036 inch.
 - 5. Frame: Minimum 0.060 inch thick sheet metal with drywall bead.
 - 6. Hinges: Continuous piano.
 - 7. Automatic Closer: Spring type.
 - 8. Latch: latch operated by pinned hex head wrench with interior release.

2.4 FINISHES

- A. Steel Finishes: Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.
 - 1. Surface Preparation for Steel Sheet: Clean surfaces to comply with SSPC-SP 1, "Solvent Cleaning," to remove dirt, oil, grease, or other contaminants that could impair paint bond. Remove mill scale and rust, if present, from uncoated steel, complying with SSPC-SP 5/NACE No. 1, "White Metal Blast Cleaning," or SSPC-SP 8, "Pickling.".
 - 2. Surface Preparation for Metallic-Coated Steel Sheet: Clean surfaces with non-petroleum solvent so surfaces are free of oil and other contaminants. After cleaning, apply a conversion coating suited to the organic coating to be applied over it. Clean welds, mechanical connections, and abraded areas, and apply galvanizing repair paint specified below to comply with ASTM A780.
 - a. Galvanizing Repair Paint: High-zinc-dust-content paint for regalvanizing welds in steel, complying with SSPC-Paint 20.
 - 3. Factory-Primed Finish: Apply shop primer immediately after cleaning and pretreating.

PART 3 - EXECUTION

3.1 COORDINATION

- A. Verification: Determine specific locations and sizes for access doors needed to gain access to concealed plumbing, mechanical, or other concealed work, and indicate in the schedule specified in "Submittals" Article.

3.2 INSTALLATION

- A. Comply with manufacturer's written instructions for installing access doors and frames.
- B. Set frames accurately in position and attach securely to supports with plane of face panels aligned with adjacent finish surfaces.
- C. Install doors flush with adjacent finish surfaces or recessed to receive finish material.

3.3 CLEANING AND PROTECTION

- A. At end of each workday, remove rubbish other discarded materials from Project site.
- B. Protect the work of other trades and work of this Section already installed against soiling and damage by the exercise of reasonable care and precautions. Repair or replace any work so damaged or soiled.
- C. At completion of construction activities of other trades, touch up and restore damaged or defaced coated surfaces.

3.4 WASTE MANAGEMENT

- A. Separate and dispose of waste in accordance with the Project's Waste Management Plan.

END OF SECTION

SECTION 083616 - SINGLE PANEL DOORS

PART 1 - GENERAL

1.1 SUMMARY

- A. Provide all labor, materials, necessary equipment and services to complete single panel storefront door as indicated on the Drawings and as specified herein. Systems include:
 - 1. Full height operable door system.
 - 2. Counter door systems.
- B. Related Documents and Sections: Examine Contract Documents for requirements that directly affect or are affected by Work of this Section. A list of those Documents and Sections include, but is not limited to the following:
 - 1. Drawings and general provisions of the Contract, including General and Supplementary Conditions and General Requirements.
 - 2. Section 055000 - METAL FABRICATIONS.
 - 3. Section 084000 - ALUMINUM-FRAMED FACADE SYSTEMS.
 - 4. Section 092900 - GYPSUM BOARD.
 - 5. Section 099100 - PAINTING.
 - 6. Division 26 - ELECTRICAL: All site wiring and connections for main power, including disconnect switches at each motor location.

1.2 SUBMITTALS

- A. Product Data: Submit manufacturer's printed descriptions of materials, components and systems, performance criteria, use limitations, recommendations and installation information. for each manufactured product specified or called out by the Drawings and this Section.
- B. Submit shop drawings showing complete layout of single panel door based on field verified dimensions. The drawings shall include dimensional relationship to adjoining work. Include details indicating materials, finishes, and tolerances, methods of attachment to building steel and electrical requirements.
- C. Samples
 - 1. Initial for Selection: Submit printed color charts or sample chains indicating manufacturer's complete range to determine color, texture, shape, and/or composition for each type of material finish exposed to view.
 - 2. Final Selection: Submit products for acceptance, those required prior to manufacturing to verify close tolerances, shapes and/or specifically required aesthetics.
- D. Quality Assurance Submittals

1. Test Reports: Submit certified test results by a recognized testing laboratory in accordance with specified test methods for each product and/or system indicating acoustic performance characteristics.
2. Certificates: Submit with manufacturer's signature certifying that each product and/or system meets the requirements of the performance characteristics, physical criteria, and applicable standards specified.

1.3 QUALITY ASSURANCE

A. Qualifications:

1. Manufacturer: A firm experienced a minimum five (5) years in manufacturing products or systems similar to those indicated for this Project and a certified ISO-9001-2000 company or an equivalent quality control system and independent test reports, which meet the requirements and design specified herein.
2. Installer: Perform installation by an authorized local distributor licensed by the folding storefront manufacturer.

B. Provide each door as a complete unit by one manufacturer, including frames, panels, brackets, guides, hardware, operators and installation accessories to suit opening.

C. Wind Loading: Design and reinforce door system to withstand a wind loading pressure to comply with state and federal code requirements.

D. Manufacturer capable of providing field service representation during installation, approving acceptable installer and approving application method.

E. Provide each door system as a complete unit by one manufacturer, including frames, panels, brackets, guides, hardware, operators and installation accessories to suit opening.

F. Pre-installation Meeting: Convene at site to verify acceptability of conditions for Work of this Section.

1.4 COORDINATION

- #### A. Work of this Section shall be coordinated with the Work of other Sections to assure the steady progress of all the Work. In no case shall Work of other Sections be concealed until it has been inspected.

1.5 WARRANTY

- #### A. Frame/Panel, hydraulic cylinders and controls shall be guaranteed for one year against defects in material and workmanship from date of delivery.

- #### B. Optional factory-supplied, manufacturers-standard glass retainer system and glass inserts shall be guaranteed for one year against defects in material and workmanship from date of delivery.

- #### C. Retainer system, glass inserts or other cladding/covering by others is not included in

this warranty.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

- A. Subject to compliance with requirements, manufacturers offering products which may be incorporated into the work, include, but are not limited to, the following:
 - 1. Basis-of-Design: Crown Doors, LLC, Plato, MN
 - 2. Overhead Door Company.
 - 3. Hörmann
 - 4. Acceptable equivalent.
- B. Upon compliance with all of the criteria specified in this section, manufacturers wishing to bid products similar to the product specified must submit to the architect - 10 days prior to bidding - complete data in support of compliance. The submitting manufacturer guarantees the proposed substituted product complies with the product specified and as detailed on the drawings.

2.2 MATERIALS

- 1. Panel frame shall be factory-welded at all joints and connections, with smooth welds not to exceed 1/4 in. thickness.
- 2. Panel frame shall be primed with gray zinc, powder- based, epoxy primer to provide corrosion resistance, and be prepared for field finishing, if required.
- 3. Factory-Supplied neoprene seals/weather stripping will be shipped loose for field-install to protect against damage during transport.
- B. Single-Swing System shall be operated by hydraulic cylinders that are mechanically fastened to the panel frame.
 - 1. Cylinders will be designed to carry the required loads during operation, open position and closed position. Internal stops will be installed as not to allow over-extension of the cylinders, therefore not allowing the system to open or close beyond its limit.
 - 2. System shall be locked closed by means of the hydraulic cylinders providing a minimum of 1000 lbs. of closing force.
- C. Power Operator: Standard voltage is 208-230v, single phase.
 - 1. "Up-Down" push button or key switch controls for separate mounting, by others.
 - 2. Power unit to operate (2) hydraulic cylinders which open and close the door/window. Power unit to be pre-wired, factory-tested and provided with supply cables for final hook-up (by others).
 - 3. "Open-Close" control units will be wired for constant-hold operation.
 - 4. Incoming electrical source to hydraulic power unit to be supplied by others (manufacturer's standard).

5. Each door operator shall have thermal overload protection for the motor.

D. Finishes

1. Entire system frame and panel shall be cleaned and primed with gray zinc, powder-based, epoxy primer, prepared for field finish.

2.3 OPERATION

- A. The Single-Swing System shall be extended/retracted in the opening using a constant-hold push-button or key switch, operating hydraulic cylinders mounted to the door/window frame.

PART 3 - EXECUTION

3.1 SAFETY

- A. Hydraulic power unit to have a manual emergency let-down valve for closing the system in case of a power outage.
- B. Single-Swing System to incorporate pressure compensated orifice valves
- C. Photo eyes or lead-edge sensor optional.

3.2 INSTALLATION

- A. Installation of the Single-Swing System shall be by a contractor familiar with this type of installation, and be in strict accordance with the approved build drawings and manufacturers standard printed specifications, instructions and recommendations. All moving parts will be left in good operating condition.
- B. Permanent or temporary electric wiring shall be brought to the power unit location before installation. After the Single-Swing System is installed, the general contractor assumes the responsibility of any damage to the system or system components during construction until the building is turned over to the owner.
- C. Fill reservoir with hydraulic fluid (provided by others). Use ATF for cold weather applications or #32 hydraulic fluid for all other applications.

3.3 CLEANING

- A. All surfaces shall be wiped clean and free of handprints, grease and oil.

3.4 TRAINING

- A. Installer shall demonstrate proper operation and maintenance procedures to owner's representative.
- B. Operating keys and owner's manual shall be provided to owner's representative.

3.5 WASTE MANAGEMENT

- A. Separate and dispose of waste in accordance with the Project's Waste Management Plan.

END OF SECTION

SECTION 084000 - ALUMINUM-FRAMED FAÇADE SYSTEMS

PART 1 - GENERAL

1.1 SUMMARY

- A. This section includes all exterior façade systems, including window walls, storefront, and punched openings. The Contractor shall engineer, test, fabricate, deliver, install, and warranty all construction necessary to provide all exterior wall systems including all measures that may be required to that end, notwithstanding any omissions or inadequacies of the Contract Documents. The work of this Section shall include all materials, components and systems necessary and incidental to the weather-tight installation of the glass and glazing systems.
- B. Related Documents and Sections: Examine Contract Documents for requirements that directly affect or are affected by Work of this Section. A list of those Documents and Sections include, but is not limited to the following:
 - 1. Drawings and general provisions of the Contract, including General and Supplementary Conditions, and Division 01 General Requirements Specification Sections, apply to this Section.
 - 2. Section 076200 - SHEET METAL FLASHING AND TRIM.
 - 3. Section 079200 - JOINT SEALANTS.
 - 4. Section 083616 - SINGLE PANEL DOORS.
 - 5. Section 085619 - TRANSACTION WINDOWS.
 - 6. Section 087100 - DOOR HARDWARE.
 - 7. Section 088000 - GLAZING.

1.2 DRAWINGS AND SPECIFICATIONS

- A. Information on Drawings and in Specifications establishes requirements for system's aesthetic effects as well as its performance and prescriptive characteristics. Aesthetic effects are indicated by dimensions, arrangements, alignment, and profiles of components and assemblies as they relate to sight lines and relationships to one another and to adjoining construction. Performance characteristics are indicated by criteria subject to verification by one or more methods including preconstruction testing, field testing, or in-service performance. Prescriptive characteristics are as specified. The drawings do not claim to fully solve movement or structural requirements, pressure equalization, waterproofing, air sealing, acoustic requirements, glass movement, seismic performance or thermal shock requirements.
- B. Do not modify intended aesthetic effects, as judged solely by Architect, except with Architect's approval. Where modifications are proposed, submit details to Architect for review.

1.3 SUBMITTALS

- A. Product Data: For each type of product indicated. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes.
- B. Product Certificates: Signed by manufacturers of glass and glazing products certifying that products furnished comply with requirements.
- C. Shop Drawings: For glazed window walls. Include plans, elevations, sections, full-size details, and attachments to other work.
 - 1. Include details of provisions for assembly expansion and contraction and for draining moisture occurring within the assembly to the exterior.
- D. Delegated-Design Submittal: For glazed window walls indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.
- E. Maintenance Data: For glazed window walls to include in maintenance manuals. Include ASTM C 1401 recommendations for post installation-phase quality-control program.

1.4 QUALITY ASSURANCE

- A. Installer Qualifications: Manufacturer's authorized representative who is trained and approved for installation of units required for this Project.
- B. Testing Agency Qualifications: Qualified according to ASTM E 699 for testing indicated.
- C. Product Options: Information on Drawings and in Specifications establishes requirements for assemblies' aesthetic effects and performance characteristics. Aesthetic effects are indicated by dimensions, arrangements, alignment, and profiles of components and assemblies as they relate to sightlines, to one another, and to adjoining construction.
 - 1. Do not revise intended aesthetic effects, as judged solely by Architect, except with Architect's approval. If revisions are proposed, submit comprehensive explanatory data to Architect for review.
- D. Structural-Sealant Glazing: Comply with ASTM C 1401 for design and installation of glazed window walls.
- E. 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."
- F. Accessible Entrances: Comply with ICC/ANSI A117.1 and State of North Carolina requirements.
- G. Energy-Performance Standards: Comply with NFRC for minimum standards of energy performance, materials, components, accessories, and fabrication. Comply with more

stringent requirements if indicated.

1. Provide NFRC-certified, glazed window walls with an attached label.
- H. Mock-ups: Before glazing, build mockups for each facade type to verify selections and to demonstrate aesthetic effects and qualities of materials and execution.
1. Construction: Build in place mockups as indicated on the drawings with glass and glazing systems specified for the project, including typical lite size, framing systems and glazing methods.
 2. Scheduling: Notify architect seven days in advance of dates and times when mockups will be available for viewing.
- I. Preinstallation Conference: Conduct conference at Project site, at least two weeks prior to fabrication and/or installation of wall system, arrange a meeting at fabrication or Project site with the glazier, sealant, and gasket manufacturers' technical representatives and any others necessary to review procedures, products to be used, and schedule for the Work. Give at least 2 weeks' notice to Architect and other concerned parties.

1.5 PROJECT CONDITIONS

- A. Field Measurements: Verify actual locations of structural supports for glazed window walls by field measurements before fabrication and indicate measurements on Shop Drawings.

1.6 WARRANTY

- A. Special Assembly Warranty: Standard form in which Installer agrees to repair or replace components of glazed window walls that do not comply with requirements or that fail in materials or workmanship within specified warranty period.
1. Failures include, but are not limited to, the following:
 - a. Structural failures including, but not limited to, excessive deflection.
 - b. Noise or vibration created by wind and thermal and structural movements.
 - c. Deterioration of metals, metal finishes, and other materials beyond normal weathering.
 - d. Water penetration through fixed glazing and framing areas.
 2. Warranty Period: 20 years from date of Material Completion.
- B. Special Finish Warranty: Standard form in which manufacturer agrees to repair finishes or replace aluminum that shows evidence of deterioration of factory-applied finishes within specified warranty period.
1. Deterioration includes, but is not limited to, the following:
 - a. Color fading more than 5 Hunter units when tested according to ASTM D 2244.
 - b. Chalking in excess of a No. 8 rating when tested according to ASTM D 4214.
 - c. Cracking, checking, peeling, or failure of paint to adhere to bare metal.

2. Warranty Period: 20 years from date of Material Completion.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. General Performance: Comply with performance requirements specified, as determined by testing manufacturer's standard of glazed window walls representing those indicated for this Project without failure due to defective manufacture, fabrication, installation, or other defects in construction.
 1. Glazed window walls shall withstand movements of supporting structure indicated on Drawings including, but not limited to, twist, column shortening, long-term creep, and deflection from uniformly distributed and concentrated live loads.
 2. Failure also includes the following:
 - a. Thermal stresses transferring to building structure.
 - b. Glass breakage.
 - c. Noise or vibration created by wind and thermal and structural movements.
 - d. Loosening or weakening of fasteners, attachments, and other components.
 - e. Failure of operating units.
- B. Seismic Requirements For Nonstructural Components:
 1. Submit seismic calculations in accordance with local and state building codes. Calculations shall be performed using a current seismic program by a structural engineer licensed in the state where the project is located. The structural engineer shall sign and seal these calculations confirming that these calculations meet all local and state codes for seismic assemblies.
 - a. Calculations shall additionally account for imposed loads, and specific project conditions.
- C. Structural Loads: As indicated on Structural Drawings.
- D. Structural-Test Performance: Provide glazed window walls tested according to ASTM E 330 as follows:
 1. When tested at positive and negative wind-load design pressures, assemblies do not evidence deflection exceeding specified limits.
 2. When tested at 150 percent of positive and negative wind-load design pressures, assemblies, including anchorage, do not evidence material failures, structural distress, and permanent deformation of main framing members exceeding 0.2 percent of span.
 3. Test Durations: As required by design wind velocity, but not less than 10 seconds.
- E. Windborne-Debris Impact Resistance: Passes ASTM E1886 missile-impact and cyclic-pressure tests in accordance with ASTM E1996 for Wind Zone 4 for enhanced protection.
 1. Large-Missile Test: For glazing located within 30 feet (9.1 m) of grade.

- F. Deflection of Framing Members: At design wind pressure, as follows:
1. Deflection Normal to Wall Plane: Limited to 1/175 of clear span for spans up to 13 feet 6 inches (4.1 m) and to 1/240 of clear span plus 1/4 inch (6.35 mm) for spans greater than 13 feet 6 inches (4.1 m) or an amount that restricts edge deflection of individual glazing lites to 3/4 inch (19 mm), whichever is less.
 2. Deflection Parallel to Glazing Plane: Limited to (3.2 mm) 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 (3.2 mm).
 - a. Operable Units: Provide a minimum 1/16-inch (1.6-mm) clearance between framing members and operable units.
 3. Cantilever Deflection: Where framing members overhang an anchor point, limit deflection to 2 times the length of cantilevered member divided by 175.
- G. Water Penetration under Static Pressure: No evidence of water penetration through fixed glazing and framing areas when tested according to ASTM E 331 at a minimum static-air-pressure differential of 20 percent of positive wind-load design pressure, but not less than (300 Pa) (480 Pa) 15 lbf/sq. ft. (720 Pa).
- H. Water Penetration under Dynamic Pressure: No evidence of water penetration through fixed glazing and framing areas when tested according to AAMA 501.1 at dynamic pressure equal to 20 percent of positive wind-load design pressure, but not less than (480 Pa) 15 lbf/sq. ft. (720 Pa).
1. Maximum Water Leakage: No uncontrolled water penetrating assemblies or water appearing on assemblies' normally exposed interior surfaces from sources other than condensation. Water leakage does not include water controlled by flashing and gutters that is drained to exterior.
- I. Thermal Movements: Design and detail wall and its components to permit thermal movement without causing buckling; glass and glazing system damage or failure; sealant failure; excess stress on framing, anchors and fasteners; reduction of performance or other detrimental effects. Allow for thermal movements resulting from the following maximum change (range) in ambient and surface temperatures:
1. Temperature Change (Range): 120 deg F (67 deg C), ambient; 180 deg F (100 deg C), material surfaces.
 2. Test Interior Ambient-Air Temperature: 75 deg F (24 deg C).
- J. Energy Performance: Glazed window walls shall have certified and labeled energy performance ratings according to NFRC.
1. Thermal Transmittance (U-Factor): Fixed glazing and framing areas shall have U-factor of not more than 0.46 Btu/sq. ft. x h x deg F (3.92 W/sq. m x K) as determined according to NFRC 100.
 2. Solar Heat Gain Coefficient: Fixed glazing areas shall have a SHGC of no greater than 0.25 as determined according to NFRC 200.
 3. Air Infiltration: Maximum air leakage through fixed glazing and framing areas of 0.06 cfm/sq. ft. (0.30 L/s per sq. m) of fixed wall area as determined according to ASTM

E 283 at a minimum static-air-pressure differential of (75 Pa)6.24 lbf/sq. ft. (300 Pa).

4. Condensation Resistance:

- a. Design the wall and its components to not develop any visible interior condensation on framing members or glazing.
- b. Provide independent laboratory test reports based on AAMA 1503, confirming wall system performance to at least the above criteria.
- c. If independent laboratory test reports are unavailable to verify thermal performance, provide computer analysis using Therm 5 and Windows 5 software as developed by Lawrence Berkeley National Laboratory. Include in the analysis at least all principle mullions for sill, jamb, and head conditions for vision lights and spandrel areas.

K. Structural Sealant: Capable of withstanding tensile and shear stresses imposed by glazed window walls without failing adhesively or cohesively. When tested for preconstruction adhesion and compatibility, cohesive failure of sealant shall occur before adhesive failure.

1. Adhesive failure occurs when sealant pulls away from substrate cleanly, leaving no sealant material behind.
2. Cohesive failure occurs when sealant breaks or tears within itself but does not separate from each substrate because sealant-to-substrate bond strength exceeds sealant's internal strength.
3. Structural-Sealant Joints:
 - a. Design reviewed and approved by structural-sealant manufacturer.

2.2 MANUFACTURERS

- A. Basis-of-Design Manufacturer: Provide Wausau Superwall SSG systems, or an Architect acceptable equivalent by one of the following:
1. YKK America.
 2. EFCO Corporation.
 3. Kawneer North America; an Alcoa Company.
 4. Oldcastle BuildingEnvelope.
 5. United States Aluminum.
 6. Acceptable equivalent.

2.3 MATERIALS

- A. Aluminum Extrusions: Alloy and temper recommended by glazed aluminum window wall manufacturer for strength, corrosion resistance, and application of required finish and not less than 0.070 in. wall thickness at any location for the main frame and complying with ASTM B 221: 6063-T6 alloy and temper.
1. Recycled Content: Shall have a minimum of 50% mixed pre- and post-consumer recycled content.
 - a. Indicate recycled content; indicate percentage of pre-consumer and post-

consumer recycled content per unit of product.

- B. Aluminum sheet alloy: Shall meet the requirements of ASTM B209.
- C. Fasteners: Aluminum, nonmagnetic stainless steel or other materials to be non-corrosive and compatible with aluminum window members, trim hardware, anchors, and other components.
- D. Anchors, Clips, and Accessories: Aluminum, nonmagnetic stainless steel, or zinc-coated steel or iron complying with ASTM B 633 for SC 3 severe service conditions or other suitable zinc coating; provide sufficient strength to withstand design pressure indicated.
- E. Reinforcing Members: Aluminum, nonmagnetic stainless steel, or nickel/chrome-plated steel complying with ASTM B 456 for Type SC 3 severe service conditions, or zinc-coated steel or iron complying with ASTM B 633 for SC 3 severe service conditions or other suitable zinc coating; provide sufficient strength to withstand design pressure indicated.
- F. Sealant: For sealants required within fabricated window wall system, provide permanently elastic, non-shrinking, and non-migrating type recommended by sealant manufacturer for joint size and movement.
- G. Tolerances: Reference to tolerances for wall thickness and other cross-sectional dimensions of glazed window wall members are nominal and in compliance with AA Aluminum Standards and Data.

2.4 FRAMING

- A. Framing Members: Manufacturer's standard extruded- or formed-aluminum framing members of thickness required and reinforced as required to support imposed loads.
 - 1. Glazing System: Retained mechanically with toggles on four sides.
 - 2. Glazing Plane: Front.
- B. Glass: Outside glazed with metal interfaced 1 in. insulating glass.
- C. Brackets and Reinforcements: Manufacturer's standard high-strength aluminum with non-staining, nonferrous shims for aligning system components.
- D. Framing Sealants: Shall be suitable for glazed aluminum window wall as recommended by sealant manufacturer.
- E. Fasteners and Accessories: Manufacturer's standard corrosion-resistant, non-staining, nonbleeding fasteners and accessories compatible with adjacent materials. Where exposed shall be stainless steel.
 - 1. Toggle Assembly: Toggle assembly as tested by manufacturer.
- F. Perimeter Anchors: When steel anchors are used, provide insulation between steel material and aluminum material to prevent galvanic action.

- G. Packing, Shipping, Handling and Unloading: Deliver materials in manufacturer's original, unopened, undamaged containers with identification labels intact.
- H. Storage and Protection: Store materials protected from exposure to harmful weather conditions. Handle window wall material and components to avoid damage. Protect window wall material against damage from elements, construction activities, and other hazards before, during and after installation.

2.5 GLAZING

- A. Glazing: Comply with Section 088000 - GLAZING.
 - 1. System: Outside toggle glazed format with 1 in. double glazed insulating glass. Interface shop applied with structural silicone.
- B. Glazing Gaskets: Gaskets to meet the requirements of ASTM C864.
- C. Spacers and Setting Blocks: Manufacturer's standard elastomeric type.
- D. Bond-Breaker Tape: Manufacturer's standard TFE-fluorocarbon or polyethylene material to which sealants will not develop adhesion.

2.6 SHADOW BOXES

- A. Infill Shadow Box Panels: 0.060 thick aluminum sheet.
 - 1. Exterior and interior finish: AAMA 2605, 70% PVDF Fluoropolymer Coating matching framing.
 - 2. Profile as shown.

2.7 OPERABLE UNITS

- A. Entrance Doors: Provide low-profile narrow-stile dry glazed entrance doors for manual-swing operation, prepped for hardware.
- B. Entrance Door Hardware: Refer to Section 087100 - DOOR HARDWARE.

2.8 ACCESSORY MATERIALS

- A. Bituminous Paint: Cold-applied asphalt-mastic paint complying with SSPC-Paint 12 requirements except containing no asbestos, formulated for 30-mil (0.762 mm) thickness per coat.

2.9 FABRICATION

- A. General Design and Fabrication Requirements
 - 1. Finish, fabricate and factory assemble window wall under the responsibility of one manufacturer, with units sized for ease of shipping, distribution and erection.

- a. Systems using individual field fabricated or field assembled members are not acceptable, unless necessitated by shipping, distribution or erection constraints.
 - b. Carrier frames (cassettes) shall be four-side silicone-glazed under controlled environmental conditions.
 - c. Attach carrier frames to main framing members using extruded aluminum clips.
 - d. Carrier frames shall be removable from the exterior for re-glazing and/or access.
 2. Provide interlocking male/female type vertical mullion "stack" joints at adjacent grid frame members with sharp, well-defined corners and flush sightlines.
 3. Conceal fasteners at vertical to horizontal main framing connections and at miscellaneous trim except as shown on architectural drawings or otherwise required.
 4. Fabricate to allow for thermal movement of materials when subjected to a temperature differential from -10°F exterior ambient temperature to $+180^{\circ}\text{F}$ exterior surface temperature without damage.
 5. System to be face-sealed at the exterior plane of the glazing.
- B. Entrance Door Frames: Reinforce as required to support loads imposed by door operation and for installing entrance door hardware.
1. At exterior doors, provide compression weather stripping at fixed stops.
 2. At interior doors, provide silencers at stops to prevent metal-to-metal contact. Install three silencers on strike jamb of single-door frames and two silencers on head of frames for pairs of doors.
- C. Entrance Doors: Reinforce doors as required for installing entrance door hardware.
1. At pairs of exterior doors, provide sliding-type weather stripping retained in adjustable strip and mortised into door edge.
 2. At exterior doors, provide weather sweeps applied to door bottoms.
- D. 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.
- E. Weather-Stripping
1. Dual durometer PVC, polypropylene, TPE, EPDM, neoprene, silicone, or other suitable material as tested and approved by the window wall manufacturer.
 2. Weather-stripping installed in integral dovetail races in framing members.
 3. One row of fin-type weather-strip at interlocking vertical mullion members to provide isolation for horizontal movement.

2.10 FINISHES

A. Exterior Aluminum Finish:

1. Fluoropolymer Coating: Provide high performance coating system consisting of primer and color finish coat conforming to AAMA 2604. Properly prepare substrates by inhibited chemical cleaning, conversion coating, and priming in compliance with

coating manufacturer's instructions and recommendations. Provide minimum 1.0 mil dry film thickness of thermo-cured fluoropolymer color coating containing minimum 50% of one of the following resins:

- a. Hylar 5000; Ausimont USA, Inc., Morristown, NJ 07962-1838
 - b. Kynar 500; Atochem North America, Inc., Philadelphia, PA 19102.
2. Color: As selected by the Architect.

B. Interior Aluminum Finish:

1. Baked-Enamel or Powder-Coat Finish: AAMA 2603. Comply with coating manufacturer's written instructions for cleaning, conversion coating, and applying and baking finish.
2. Color and Gloss: As selected by the Architect.

2.11 SOURCE QUALITY CONTROL

- A. Perform quality-control procedures complying with ASTM C 1401 recommendations including, but not limited to, assembly material qualification procedures, sealant testing, and assembly fabrication reviews and checks.

PART 3 - EXECUTION

3.1 EXAMINATION

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

3.2 INSTALLATION

A. General:

1. Comply with manufacturer's written instructions.
2. Do not install damaged components.
3. Fit joints to produce hairline joints free of burrs and distortion.
4. Rigidly secure nonmoving joints.
5. Install anchors with separators and isolators to prevent metal corrosion, electrolytic deterioration, and impediments to movement of joints.
6. Perform field welding under the same requirements specified for shop welding.
7. Weld components in concealed locations to minimize distortion or discoloration of finish. Protect glazing surfaces from welding.
8. Thoroughly clean welds and adjoining burned areas on primed surfaces and then paint the areas with priming paint of type used for shop coats, or zinc rich paint for galvanized steel.
9. Seal joints watertight unless otherwise indicated.

B. Metal Protection:

1. Where aluminum will contact dissimilar metals, protect against galvanic action by painting contact surfaces with primer, applying sealant or tape, or installing nonconductive spacers as recommended by manufacturer for this purpose.
 2. Where aluminum will contact concrete or masonry, protect against corrosion by painting contact surfaces with bituminous paint.
- C. Install components to drain water passing joints, condensation occurring within framing members, and moisture migrating within glazed window walls to exterior.
- D. Install components plumb and true in alignment with established lines and grades.
- E. Install glazing as specified in Section 088000 - GLAZING. Prepare surfaces that will contact structural sealant according to sealant manufacturer's written instructions to ensure compatibility and adhesion. Preparation includes, but is not limited to, cleaning and priming surfaces.
- F. Perform no structural-sealant-glazing prior to written certification of adhesion and compatibility test results, review and written approval of glazing details by glass and sealant manufacturers and acceptance of written quality assurance program.
- G. Install weatherseal sealant according to Section 079200 - JOINT SEALANTS and according to sealant manufacturer's written instructions to produce weatherproof joints. Install joint filler behind sealant as recommended by sealant manufacturer.

3.3 ERECTION TOLERANCES

- A. Erection Tolerances: Install to comply with the following non-accumulating maximum tolerances:
1. Plumb: 1/8 inch in 10 feet (3 mm in 3 m); 1/4 inch in 40 feet (6 mm in 12 m).
 2. Level: 1/8 inch in 20 feet (3 mm in 6 m); 1/4 inch in 40 feet (6 mm in 12 m).
 3. Alignment:
 - a. Where surfaces abut in line or are separated by reveal or protruding element up to 1/2 inch (12.7 mm) wide, limit offset from true alignment to 1/16 inch (1.6 mm).
 - b. Where surfaces are separated by reveal or protruding element from 1/2 to 1 inch (12.7 to 25.4 mm) wide, limit offset from true alignment to 1/8 inch (3.2 mm).
 - c. Where surfaces are separated by reveal or protruding element of 1 inch (25.4 mm) wide or more, limit offset from true alignment to 1/4 inch (6 mm).
 4. Location: Limit variation from plane to 1/8 inch in 12 feet (3 mm in 3.7 m); 1/2 inch (12.7 mm) over total length.

3.4 FIELD QUALITY CONTROL

- A. Testing: Commissioning Agent to perform tests and inspections.
1. Water Spray Test: Before installation of interior finishes has begun, areas

designated by Architect shall be tested according to AAMA 501.2 and shall not evidence water penetration.

- a. Test Area: Perform tests on representative areas of glazed aluminum exterior envelope as designated by the Architect representing no less than 10% of the total combined area.
 - b. Tests shall be performed a minimum of three times prior to completion at 10, 35, and 70 percent. Contractor shall provide a lift for use by the field test staff.
- B. Glazed aluminum window walls will be considered defective if they do not pass tests and inspections.
- C. Prepare test and inspection reports.

3.5 WASTE MANAGEMENT

- A. Separate and dispose of waste in accordance with the Project's Waste Management Plan.

END OF SECTION

SECTION 084426.19 - STRUCTURAL GLASS CANOPIES

PART 1 - GENERAL

1.1 SUMMARY

- A. Section includes glass, glazing and connections for the structural glass canopy in accordance with the Contract Documents.
- B. Related Documents and Sections: Examine Contract Documents for requirements that directly affect or are affected by Work of this Section. Other Documents and Sections that directly relate to work of this Section include, but are not limited to:
 - 1. General provisions of the Contract, including General and Supplementary Conditions, and Division 01 General Requirements Specification Sections.
 - 2. Section 055000 - METAL FABRICATIONS.
 - 3. Section 051213 - ARCHITECTURALLY EXPOSED STRUCTURAL STEEL.
 - 4. Section 079200 - JOINT SEALANTS.

1.2 SYSTEM DESCRIPTION

- A. Manufacturer:
 - 1. The following specifications and related drawings are based on the performance of the Pilkington Planar System as a standard of quality. Other manufacturers listed below will be accepted if and only if they comply in all respects with the drawings and profiles shown, as well as all elements of the specifications contained herein. Manufacturer must have a minimum of five years' experience in the U.S./Canada in tall structural glass projects and must submit a minimum of ten other projects completed in the U.S. within the last five years similar to the scope of this project.
 - 2. The substitution request must be submitted no less than 15 days prior to bid with all testing and performance criteria to demonstrate compliance with specifications for Architect review. Requests submitted after this time will not be accepted.
- B. Design Requirements: Per ASCE-7:
 - 1. Wind Load (Typical): 90psf combined positive and negative
 - 2. Snow Load (Maximum Drift): 11psf (plus 5PSF rain-on-snow surcharge)
 - 3. Live load deflection of supporting structure if any: to be no more than 0.75".
- C. Pilkington Planar Glazing System:
 - 1. Fittings are designed to give flush appearance to outward surface of glazing system. NO EXTERIOR FITTINGS OR PLATES WILL BE PERMITTED.
 - 2. The design of the Planar fittings is the sole responsibility of Manufacturer/Fabricator
 - 3. Spring plate members are designed to prevent high stress concentration at the hole positions and must cope with:
 - a. Negative and positive wind loading

- b. Seismic loads
 - c. Thermal movement
 - d. Construction tolerances
 - e. Live load and dead load movements
- 4. Movement diaphragms of stainless steel and durable flexible discs must be incorporated in connections to accommodate oversize holes in spring plate members, which allow for thermal movement and glass manufacturing tolerances.
 - 5. The system shall provide for unitized pre-fixing of all items to glass prior to erection.

1.3 SUBMITTALS

A. Submit the following in accordance with Section: to be filled in by architect.

- 1. Shop Drawings: Shop drawings shall clearly indicate materials and methods, indicate coordination with other trades, and bear signed approval of the glazing system manufacturer and the glazing system installer, as well as the stamp of a licensed Professional Engineer in the State of North Carolina.
- 2. Product Data: Material description and installation instructions for tapes, compounds, gaskets and other materials.
- 3. Samples:
 - a. Submit one sample of glass and glazing materials required for the Project. Samples of glass shall be 12" x 12", samples of sealant or gasket shall be 12" long.
 - b. Submit samples of hardware complete with glass, bolt and accessories.
- 4. Quality Assurance Compliance: Submit letters from Pilkington's authorized representative and from the project installer stating that they are in compliance with the requirements of the Contract Documents.
- 5. Calculations: Submit calculations proving structural glazing systems performance and compliance with specified loads with stamp of licensed Professional Engineer registered in the State of North Carolina.
- 6. Test Reports: Submit test reports from an independent laboratory certifying that the structural glazing system proposed for use has been tested. The system tested must be similar in type of materials and design shown on Architect's drawings, utilizing countersunk bolted attachments through the glass. If existing test reports are to be submitted, then those tests shall have been carried out to loads at least equal to or greater than those called for in this specification. If test reports are not available, system shall be tested. All costs for testing will be borne by the glass system manufacturer. No system shall be accepted that has not been tested.
- 7. Letter signed by the glass manufacturer clearly stating the glass and fittings to be used on the project of the manufacturer's system are acceptable to the manufacturer and that they have reviewed the contract documents and will issue a project specific twelve (12) year warranty from date a production to include the entire system. Letters signed by the subcontractor for this section are not acceptable. System must be manufactured from one source. Glass cannot be supplied by one manufacturer and hardware from another to comply with this warranty.

1.4 QUALITY ASSURANCE

- A. Sole Source Responsibility: Glazing Material and System Design: Glass, glazing, system design and accessories are the sole responsibility of Manufacturer/Fabricator.
- B. Sole Source Responsibility: Provide installation by installer acceptable to Manufacturer/Fabricator. Provide a letter signed by representative of Manufacturer/Fabricator with company's authorization stating that installer is acceptable and qualified to install system.
 - 1. The installer of the Pilkington Planar System is responsible for supplying and erecting the complete structural glazing system, coordinating and maintaining tolerances between structure and glazing system with individual suppliers and manufacturers, and installation of glazing system.
- C. Where safety glass is indicated or required by authorities having jurisdiction, provide type of products which comply with ANSI Z97.1 and testing requirements of 16 CFR, Part 1201 for category II materials.

1.5 WARRANTIES

- A. Manufacturer Warranty: Comprehensive system warranty must be issued by the Pilkington Planar/manufacturer for a period of twelve (12) years from the date of production for design integrity, weatherability and durability of the system. Partial warranties for the glass or fittings only issued by anyone other than the glass system manufacturer will not be acceptable.
- B. Installer Warranty: Warrant the installation for a period of five (5) years for installation and repairs of failures. Provide written requirements for notification of installer and terms for maintaining warranty provisions. Do not contradict the requirements of the Contract Documents.
- C. The Warranties submitted under this Section shall not deprive the Owner of other rights or remedies that the Owner may have under other provisions of the Contract Documents and the laws of governing jurisdictions and is in addition to and runs concurrently with other warranties made by the Contractor under requirements of the Contract Documents.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. Structural Glass Canopy System: The drawings and specifications herein are based on The Pilkington PLANAR system distributed by: W&W Glass, LLC, Nanuet, NY.
 - 1. JE Berkowitz.
 - 2. TriPyramid.
 - 3. Acceptable equivalent.
- B. Glass Materials:

1. Float Glass: ASTM C 1036, Type I, Class I (clear), Quality-Q3; and with visible light transmission of not less than 88 percent.
2. Fully Tempered Float Glass: ASTM C 1048, Kind FT (fully tempered), Condition A (uncoated) unless otherwise indicated, Type I, Class 1 (clear), Quality-Q3.

C. Glass Make-up:

1. 22mm Optiwhite Low-Iron Silk-screened SentryGlas Laminated Glass consisting of
 - a. 10mm Optiwhite Low-Iron Tempered with Standard 40% Mesh Silk-Screened Pilkington Ceramic Frit Pattern in Custom Grey Color (As selected by architect) on #2 surface
 - b. 1.52mm SentryGlas ionoplast clear interlayer
 - c. 10mm Optiwhite Low-Iron Tempered Laminated Glass
2. Glass must be tempered to a minimum compressive strength of 16,000 PSI. Glass tempered to lower strengths will not be accepted.
3. Laminate to be used shall be SentryGlas (licensed by Kuraray) structural ionoplast interlayer. PVB interlayer will not be accepted.
4. Statistical heat soaking of tempered glass will not be acceptable. All tempered glass must be heat soak tested to help lower the probability of spontaneous breakage due to nickel sulfide inclusions. The heat soak test is a destructive test. It converts nickel sulfide inclusions from alpha phase to beta phase so that the glass will fracture in test chamber if present in certain layers of glass. Heat soak testing must comply with European DIN Standard 18516-4 and must be a minimum 15-hour cycle at a temperature of 290 deg C. Written warranties against nickel sulfide inclusions in lieu of heat soaking will not be accepted.
5. All glass must be horizontally tempered eliminating tong marks.
6. All edges will be ground flat with a frosted appearance unless otherwise noted.
7. All edgework, holes and notches in the tempered glass panels will be completed before tempering and shall comply with the following requirements:
 - a. Dimensional tolerance on panel size will be ± 1 mm of the theoretical dimension required for dimensions under 2 meters and 2 mm for dimensions greater than 2 meters.
 - b. Squareness of each panel will be within 3 mm.
 - c. Bow allowance is 0.1%.
 - d. The positional tolerances on all holes will be ± 1 mm from a single datum point.
8. Dimensional tolerance on each panel size making up the laminated Planar unit will be as for the single Planar specification indicated below:
 - a. For thinner glasses these tolerances will vary.
 - 1). Flat Glass Thickness:
 - a). 10,12 mm: plus or minus 0.3 mm
 - b). 15 mm: plus or minus 0.5 mm
 - c). 19 mm: plus or minus 1.0 mm
 - 2). Diagonal Tolerances
 - a). Up to 4 m: 3 mm maximum difference
 - b). Over 4 m: 4 mm maximum difference
9. The laminating process introduces a positional tolerance for one plate relative to the

other. The overall tolerance will therefore be 0 to +4 mm.

- a. Flat Shape Capability - Simple Shapes
 - b. All tolerances will vary depending on complexity of shape.
10. Flatness of glass is a key element of this specification. Average roller-wave distortion must be certified not to exceed an average of 0.02mm for uncoated tempered glass or 0.05mm for low-e coated tempered glass per linear meter with maximum sag at the leading and trailing edge of 0.25 mm. A site inspection, if required for roller wave and bow tolerances, should be from a minimum distance of 3 meters.
 11. All glass must be manufactured in a factory where the quality control procedures are created under the terms of ISO 9000 and are independently monitored.
 12. Pre-stress glass around holes to a level which is compatible with the design and sue of the fittings. Check by differential surface refractometer on stress level.

D. Fittings:

1. Planar fittings shall be predominantly manufactured from stainless steel Grade 316. Standard fittings will be Planar Type 905 type with flush countersunk bolt.
2. The subcontractor shall demonstrate to the Architect's satisfaction that the stresses induced in the glass by these fittings are compatible with the strength of the glass and the needs of the performance section of this specification.
3. The finish of all fittings will be "as machined".
4. Spring plates shall be designed to the Architect's specification. The design shall be shown by the Subcontractor to be compatible with the performance specification in all respects. Spring plates shall provide a tolerance capability which will cope with the full range of movements shown below:
 - a. Thermal movements occurring as a result of differential coefficients of thermal expansion within the range specified. The components used within the system shall withstand noiselessly all thermal movements without any buckling, distortion, cracking, failure of joint seals or undue stress on the glass or fixing assemblies.
 - b. Deflection of edge beams due to loading applied after erection of the cladding to magnitude specified.
 - c. Maximum side sway of structure due to wind load to the magnitude specified or seismic movement to the degree specified.
 - d. Deflection due to self-weight of the Planar system.
 - e. Inward and outward movements due to the design wind loads specified.
5. Countersunk Planar bolts will be bright machine finished, socket head bolt diameter 1-1/8" with hexagonal shank, stainless steel Type 316. No exterior plates, caps, disks or buttons will be permitted unless in an underslung canopy application as advised by Manufacturer/Fabricator.
6. Bushings will be Nylatron Polyamide.
7. Gaskets will be fully vulcanized fiber, neoprene or precured silicone.
8. Flat steel gusset plates to connect Pilkington Planar canopy glass to structure by others to be supplied by W&W Glass in primed painted, carbon steel for welding to structure by subcontractor. Finish painting is to be by others.
9. Steel structure for canopy to be supplied and engineered by others per specification

section 055000.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine surfaces receiving the Work. Verify dimensions of in-place and subsequent construction. Follow the recommendations of the FGMA as to inspection procedures. Do not begin work until unsatisfactory conditions have been corrected. Installation of work shall constitute acceptance of the related construction.

3.2 PREPARATION

- A. Pre-Installation Meeting: Meet at the project site with the representatives of the glass and glazing materials manufacturers, architectural exposed structural steel fabricator and erector, sealant manufacturer, the glazing installer, Architect's representative and Owner's representative. Review the glazing procedure and schedule, including the method of delivering and handling glass, and installing glazing materials. The chemical compatibility of all glazing materials and framing sealants with each other and with like materials used in glass fabrication shall be established.

3.3 INSTALLATION OF GLASS:

- A. Install in accordance with Manufacturer/Fabricator's requirements and the shop drawings.
- B. Employ only experienced glaziers who have had previous experience with the materials and systems being applied. Use tools and equipment recommended by the glass manufacturer.
- C. Plate to plate joints of glass are sealed with silicone sealant. Joint dimensions shall be designed to be compatible with sealant properties and live load movement of the structure.
- D. Bolt Torque: Torque bolts to torques specified on shop drawings using calibrated tool. Lock torqued bolts into position to prevent backoff. Reset calibrations regularly to ensure accurate torquing.
- E. Maintain a minimum temperature of 40 degrees F. during glazing unless the manufacturer of the glazing material specifically agrees to application of this material at lower temperature. If job progresses or other conditions require glazing work when temperature is below 40 deg F. (or below the minimum temperature recommended by the manufacturer), consult the manufacturer and establish the minimum provisions required to ensure satisfactory work.
- F. Clean glazing connectors receiving glazing materials of deleterious substances which might impair the work. Remove protective coatings which might fail in adhesion or interfere with bond of sealants. Comply with manufacturer's instructions for final wiping of surfaces immediately before application of primer and glazing sealants. Wipe metal surfaces with xylol or toluol.

- G. Inspect each unit of glass immediately before installation. Glass which has significant impact damage at edges, scratches or abrasion of faces, or any other evidence of damage shall not be installed.
- H. Sealants: Prime surfaces to receive glazing sealants where required, in accordance with manufacturer's recommendations, using recommended primers.
- I. Locate setting blocks, if required by the drawings, at the quarter points of sill, but no closer than 6 inches to corners of glass. Use blocks of proper sizes to support the glass in accordance with manufacturer's recommendations.
- J. Provide spacers to separate glass from spring plates.
- K. Set glass in a manner which produces greatest possible degree of uniformity in appearance. Face all glass, which has dissimilar faces, with matching faces in the same direction.
- L. Use masking tape or other suitable protection to limit coverage of glazing materials to the surfaces intended for sealants.
- M. Tool exposed surfaces of glazing materials.
- N. Clean excess sealant from glass and support members immediately after application, using solvents or cleaners recommended by manufacturers.

3.4 CURING, PROTECTION, AND CLEANING

- A. Cure sealants in accordance with the manufacturer's instructions to attain maximum durability and adhesion to glass.
- B. Clean all surfaces after installation, leaving all in a clean and workmanlike manner.
- C. Final cleaning and protection after installation is the responsibility of others.

3.5 WASTE MANAGEMENT

- A. Separate and dispose of waste in accordance with the Project's Waste Management Plan.

END OF SECTION

SECTION 086213 - TUBULAR DAYLIGHTING DEVICES

PART 1 - GENERAL

1.1 SUMMARY

- A. Work of this Section includes:
 - 1. Tubular daylighting devices, consisting of roof dome, reflective tube, diffuser assembly, and all accessories necessary for a complete installation.
- B. Related Documents and Sections: Examine Contract Documents for requirements that directly affect or are affected by Work of this Section. A list of those Documents and Sections include, but is not limited to the following:
 - 1. Drawings and general provisions of the Contract, including General and Supplementary Conditions, and Division 01 General Requirements Specification Sections, apply to this Section.
 - 2. Section 061053 - MISCELLANEOUS ROUGH CARPENTRY.
 - 3. Section 075423 - THERMOPLASTIC POLYOLEFIN (TPO) ROOFING.

1.2 SUBMITTALS

- A. Product Data: Manufacturer's data sheets on each product to be used, including:
 - 1. Preparation instructions and recommendations.
 - 2. Storage and handling requirements and recommendations.
 - 3. Installation methods.
- B. Shop Drawings. Submit shop drawings showing layout, profiles and product components, including anchorage, flashings and accessories.
- C. Verification Samples: As requested by Architect.
- D. Test Reports: Independent testing agency or evaluation service reports verifying compliance with specified performance requirements.

1.3 PERFORMANCE REQUIREMENTS

- A. Completed tubular daylighting device assemblies shall be capable of meeting the following performance requirements:
 - 1. Air Infiltration Test: Air infiltration will not exceed 0.30 cfm/sf aperture with a pressure delta of 1.57 psf across the tube when tested in accordance with ASTM E 283.
 - 2. Water Resistance Test: No uncontrolled water leakage at 10.5 psf pressure differential with water rate of 5 gallons/hour/sf when tested in accordance with

ASTM E 547.

3. Uniform Load Test:

- a. No breakage, permanent damage to fasteners, hardware parts, or damage to make system inoperable or cause excessive permanent deflection of any section when tested at a Positive Load of 150 psf (7.18 kPa) or Negative Load of 60 psf (2.87 kPa) in accordance with ICC AC-16 Section A, or Negative Load of 70 psf (3.35 kPa) if tested per ICC AC-16 Section B.
- b. All units shall be tested with a safety factor of (3) for positive pressure and (2) for negative pressure, acting normal to plane of roof in accordance with ASTM E 330.

4. Fire Testing:

- a. Self-Ignition Temperature - Greater than 650 degrees F per ASTM D-1929.
- b. Smoke Density - Rating no greater than 450 per ASTM Standard E 84 in way intended for use. Classification C.
- c. Rate of Burn and/or Extent - Maximum Burning Rate: 2.5 inches/min (62 mm/min) Classification CC-2 per ASTM D 635.
- d. Rate of Burn and/or Extent - Maximum Burn Extent: 1 inch (25 mm) Classification CC-1 per ASTM D 635.

1.4 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Engaged in manufacture of tubular daylighting devices for minimum 15 years.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Store products in manufacturer's unopened packaging until ready for installation.
- B. Store and dispose of solvent-based materials, and materials used with solvent-based materials, in accordance with requirements of local authorities having jurisdiction.

1.6 PROJECT CONDITIONS

- A. Maintain environmental conditions (temperature, humidity, and ventilation) within limits recommended by manufacturer for optimum results. Do not install products under environmental conditions outside manufacturer's absolute limits.

1.7 WARRANTY

- A. As defined in the Owner/Contractor Agreement.

PART 2 - PRODUCTS

2.1 TUBULAR DAYLIGHTING DEVICES

- A. Provide products of Solatube International, Inc., Vista, CA, or equivalent acceptable to

the Architect by one of the following:

1. Natural Light Energy Systems.
 2. VELUX America, Inc.
 3. Acceptable equivalent.
- B. Product Description: Transparent roof-mounted skylight dome and self-flashing curb, reflective tube, and ceiling level diffuser assembly, transferring sunlight to interior spaces; complying with ICC AC-16.
- C. Skylights shall be prefabricated single dome type unit skylight.
1. Size: As selected by the Architect.
 2. Aluminum members shall be extruded 6063 aluminum with a minimum thickness of 0.094 in.
 3. Cap fasteners shall be 1/4 in. diameter stainless steel with stainless steel and neoprene sealing washers, spaced a maximum of 12 in. o.c.
 4. Internal fasteners shall be stainless steel.
 5. Glazing seal shall be butyl sealant tape to allow for thermal movement of polycarbonate glazing.
 6. Polycarbonate dome shall be 0.125 in. thick with UV absorbing qualities, visible light transmission of 92%.

2.2 ACCESSORIES

- A. Fasteners: Same material as metals being fastened, non-magnetic steel, non-corrosive metal of type recommended by manufacturer, or injection molded nylon.
- B. Sealant: Polyurethane or copolymer based elastomeric sealant as provided or recommended by manufacturer.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Do not begin installation until substrates have been properly prepared.
- B. If substrate preparation is the responsibility of another installer, notify Architect of unsatisfactory preparation before proceeding.

3.2 PREPARATION

- A. Clean surfaces thoroughly prior to installation.
- B. Prepare surfaces using the methods recommended by the manufacturer for achieving the best result for the substrate under the project conditions.

3.3 INSTALLATION

- A. Install in accordance with manufacturer's printed instructions.
- B. After installation of first unit, field test to determine adequacy of installation. Conduct water test in presence of Owner, Architect, or Contractor, or their designated representative. Correct if needed before proceeding with installation of subsequent units.

3.4 PROTECTION

- A. Protect installed products until completion of project.
- B. Touch-up, repair or replace damaged products before Substantial Completion.

3.5 WASTE MANAGEMENT

- A. Separate and dispose of waste in accordance with the Project's Waste Management Plan.

END OF SECTION

SECTION 087100 - DOOR HARDWARE

PART 1 - GENERAL

1.1 GENERAL REQUIREMENTS

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

1.2 WORK INCLUDED

- A. Work of this Section includes all labor, materials, and equipment and services necessary to furnish all the finish hardware as shown on the drawings and specified herein.
- B. The required hardware items for doors are indicated in hardware sets shown herein. Should any opening be omitted, the contractor shall contact the Architect for the correct hardware.

1.3 SUBMITTALS:

- A. General: Submit the following in accordance with the provisions of the general contract documents.
- B. Hardware Schedule: Submit five (5) copies of the hardware schedule. Follow Door and Hardware Institute (DHI) guidelines for scheduling. At the beginning of the schedule furnish an index which list each door number with appropriate heading number and hardware set number. Furnish initial draft of schedule at the earliest possible date, in order to facilitate the fabrication of other work. Furnish final schedule after samples, manufacturer's data sheets have been approved. **HORIZONTAL SCHEDULES WILL NOT BE ACCEPTED.**
- C. Product Data: Submit five (5) copies of the manufacturer's data for each item of hardware. Include whatever information may be necessary to show compliance with requirements.
- D. Keying Schedule: A key schedule showing all key numbers and spaces to which each permits entry, shall be provided. Consult with Owner before submitting final key schedule. After final approval has been received, the schedule and the key cabinet, along with the key gathering envelopes containing keys for each lock endorsed with lock number and space designation, shall be turned over to the Owner.
- E. Samples: Prior to submittal of the final hardware schedule and prior to delivery of hardware, submit one (1) sample of each exposed hardware unit. Samples will be reviewed by the Architect for design, color and texture only. Compliance with other requirements is the exclusive responsibility of the Contractor. Samples approved by the Architect shall be turned over to the Owner.
- F. Wiring Diagrams: Supplier shall furnish riser diagrams, wiring diagrams and point to point diagrams for all electrical hardware specified herein. These diagrams shall be included

with the initial draft of the hardware schedule.

1.4 QUALITY ASSURANCE

- A. Standards: All finish hardware shall conform to all of the following standards:
 - 1. Testing Laboratories: Underwriters Laboratory (UL) and or Warnock Hersey Fire Laboratories Division: All fire rated doors shall have hardware assemblies approved by one of the listed laboratories. Panic hardware UL Listed only.
 - 2. National Fire Protection Association: NFPA 80 and NFPA 101.
 - 3. Builders Hardware Manufacturers Association (BHMA).
 - 4. American National Standards Institute (ANSI).
 - 5. American Disabilities Act (ADA).
- B. All products specified shall comply with the Buy American Act.
- C. Supplier: Finish hardware shall be furnished by those having a minimum of 5 years of builder's hardware experience and shall have in their employ at least one certified Architectural Hardware Consultants (AHC) to correctly interpret the plans, detailed drawings and specifications.

1.5 PRODUCT HANDLING

- A. Handle, store, distribute, protect and install in accordance with the manufacturer's instructions. Deliver packaged material in original containers with seals unbroken and labels intact. Deliver assemblies completely identified and with adequate protection for storage, handling and installation.
- B. Provide secure lock-up for hardware delivered to the project, but not yet installed. Control the handling and installation of hardware which are not immediately replaceable, so that completion of the work will not be delayed by hardware losses; both before and after installation.

1.6 PROJECT CONDITIONS

- A. Coordinate hardware with other work. Tag each item or package separately, with identification related to the final hardware schedule, and include basic installation instructions in the package. Furnish hardware items of proper design for use on doors and frames of the thickness, profile, swing, security and similar requirements indicated and as necessary for proper installation and function. Deliver packaged hardware items to the proper locations for installation.
- B. Furnish hardware templates to each fabricator of doors, frames and other work to be factory prepared for the installation of hardware.

1.7 WARRANTIES

- A. The hardware manufacturers shall provide full replacement warranty as listed below.

- | | |
|-------------------------|-----------|
| 1. Surface Closers: | 25 years. |
| 2. Locksets, etc.: | 1 year |
| 3. Exit Devices: | 3 years |
| 4. Balance of hardware: | 1 year |

PART 2 - PRODUCTS

2.1 MATERIALS AND FABRICATION

- A. Hand of Door: The drawings show the swing or hand of each door leaf. Furnish each item of hardware for proper installation and operation of the door swing shown.
- B. Base Metals: Produce hardware units of the basic metal and forming method indicated, using manufacturer's standard metal alloy, composition, temper and hardness but in no case of lesser quality material.
- C. Fasteners: Manufacture hardware to conform to published templates, generally prepared for machine screw installation. Do not provide hardware, which has been prepared for self-tapping sheet metal screws.
- D. Screws: Furnish screws for installation, with each hardware item. Finish exposed screws to match the hardware finish.
- E. Tools for Maintenance: Furnish a complete set of specialized tools as needed, for the Owner's continued maintenance, removal and replacement of hardware.
- F. Concealed Fasteners: Provide concealed fasteners for hardware units which are exposed when the door is closed except to the extent no standard manufacturer's units are available with concealed fasteners. Use thru bolts only where necessary to adequately fasten hardware to the door.

2.2 HINGES

- A. All hinges shall be full mortise three knuckle bearing type, template hinge.
- B. All hinges for 1-3/4 in. thick doors shall be 4-1/2 in. wide in the open position. For other thickness doors hinges shall be of a width to permit unobstructed swing of the doors.
- C. Size and weight of hinges shall conform to the following:
 - 1. Up to 36 in.: 4-1/2 in. Standard Weight
 - 2. Over 36 in. to 44 in.: 5 in. Heavy Weight
 - 3. Over 44 in.: Continuous Hinge Stanley 661HD
- D. Quantity of hinges and spring hinges shall be provided to conform to the following:
 - 1. Doors up to 60 in. in height: 2 hinges
 - 2. Doors 60 in. to 89 in. in height: 3 hinges
 - 3. Doors 90 in. and over: 1 hinge every 30 in. in height

- E. All hinges shall be the products of one manufacturer and furnished as specified, unless otherwise noted.

2.3 LOCKSETS, LATCHSETS ETC.

- A. All locksets and latchsets shall be heavy-duty mortise type, function as specified in hardware sets, unless otherwise noted.

2.4 KEYS AND KEYING

- A. Keys: All keys shall be nickel silver. Furnish a quantity of keys as follows.
 - 1. Grandmaster Keys: 2 each per group
 - 2. Master Keys: 2 each per group
 - 3. Change Keys: 3 each per cylinder
 - 4. Construction Keys: 5
 - 5. Control Keys: 5
- B. Keying: All locks shall be construction keyed and great grand master keyed to a new Schlage keying system. Hardware supplier shall meet with the Owner to establish the keying requirements for this project. All master keys shall be hand delivered to the Owner by the manufacturer or his representative.
- C. Cylinders: All cylinders shall be min. six pin interchangeable core with visual key control.
- D. Key Cabinet: Provide a key control system set-up to include envelopes, labels, tags with self-locking key clips, receipt forms, 3-way visible card index, temporary markers, permanent markers and standard metal cabinet with locked access. Capacity for 150% of the number of locks required for this project. Instruct Owner's representative on the operation of the key control system.

2.5 DOOR CLOSING DEVICES

- A. All surface door closers shall meet ANSI A156.4 Grade 1 requirements, unless otherwise noted. Furnish all required brackets, filler plates and any other items required to insure proper installation and operation.
- B. All closers shall be installed so that closer bodies are positioned on room side of doors to and from corridors, i.e., in-swing doors shall be regular arm. Out-swing doors shall have a parallel arm. Regular arm shall be used in connecting doors between rooms.

PART 3 - EXECUTION

3.1 GENERAL

- A. Approval: As soon as practical after award of Contract and before a hardware schedule is prepared, and before any hardware is ordered or delivered to the project, the Contractor shall submit to the Architect for his written approval, copies of sample list, listing each of

the different items of builders hardware and catalog cuts of each item.

- B. Templates: As soon as the hardware schedule is approved the hardware supplier shall furnish to the various fabricators, required templates for fabrication purposes. Templates shall be made available not more than (10) days after receipt of the approved hardware schedule.
- C. Packaging and Marking: All hardware shall be shipped with proper fastenings for secure application. Each package of hardware shall be legibly marked indicating the part of the work for which it is intended. Markings shall correspond with the door tag numbers shown on the approved hardware schedule. Keys shall be tagged within each package set and plainly marked on the face of the envelope with the key control number, door designation and all identification as necessary.
- D. Delivery: Delivery shall be made to the project site to the attention of the General Contractor. Where delivery of special hardware is required at any fabricator's plant, the hardware supplier shall make such delivery. Hardware supplier shall furnish a representative to the job site to check in all hardware.

3.2 INSTALLATION

- A. Mount hardware units at heights recommended in "Recommended Locations for Builders Hardware" by BHMA, unless otherwise noted or directed by the Architect.
- B. Install each hardware unit in compliance with the manufacturer's recommendations.

3.3 ADJUST AND CLEAN

- A. Adjust and check each operating item of hardware and each door to ensure proper operation or function of every unit. Lubricate moving parts with type lubrication recommended by manufacturer. Replace units that cannot be adjusted.
- B. Wherever hardware installation is made more than one (1) month prior to acceptance or occupancy of a space or area, return to the work during the week prior to acceptance make a final check, and adjust all hardware items in such space or area. Adjust door control devices and compensate for final operation of heating and ventilating equipment.
- C. Instruct Owner's personnel in proper adjustment and maintenance of hardware and hardware finishes, during the final adjustment of hardware.

3.4 HARDWARE SETS

- A. The following is a general listing of hardware requirements and is not intended for use as a final hardware schedule. Any items of hardware required by established standards or practices, or to meet state and local codes or proper door operation shall be furnished whether or not specifically called out in the following listed groups. All exterior door hardware shall be hurricane resistant.

HARDWARE SET # 1

Each to have:

1	set Pivots	Rixson L147 x SPLO x US26D
1	Intermediate Pivot	Rixson M19 x SPLO x US26D
1	Deadlock	Schlage L460T x US26D
1	Permanent Core	Dorma (to suit) x US26D
1	Custom Pull	(see details) x US32D
1	Closer/Hold Open	Dorma 8916-PHP x 689
1	set Weatherstripping	Legacy Mfg. 5924 jambs/head
1	Door Bottom	Legacy 79418MA

Note:

Furnish pivot set and intermediate pivot with special offset to suit cladding detail.
Furnish extended cylinder to suit cladding detail.

HARDWARE SET # 1A

Each to have:

1	set Pivots	Rixson 147 x 3/4" Offset x US26D
1	Intermediate Pivot	Rixson M19 x 3/4" Offset x US26D
1	Deadlock	Schlage L460T x US26D
1	set Full Height Push Pulls	Rockwood RM3400 x BTB x US32D
1	Permanent Core	Dorma (to suit) x US26D
1	set Full Height Push Pulls	Rockwood RM3410 x BTB x US32D
1	set Weatherstripping	Legacy Mfg. 5924 jambs/head
1	Door Bottom	Legacy 79418MA

HARDWARE SET # 2

Each to have:

1	set Pivots	Rixson 147 x 3/4" Offset x US26D
1	Intermediate Pivot	Rixson M19 x 3/4" Offset x US26D
1	Deadlock	Schlage L463T x US26D
1	Permanent Core	Schlage (to suit) x US26D
1	set Push Pulls	Trimco 1894-4B x US32D
1	Closer	Dorma 8916-AF x 689
1	Stop	Trimco 1201 x US32D
1	set Weatherstripping	Legacy Mfg. 5574CA jambs/head
1	Door Bottom	Legacy Mfg. 7553MA
1	Saddle	Legacy Mfg. (as detailed)

HARDWARE SET # 3

Each to have:

2	set Pivots	Rixson 147 x 1 ½" Offset x US26D
2	Intermediate Pivot	Rixson M19 x 1 ½" Offset x US26D
2	Flush Bolts	Trimco W3917 x US26D
1	Deadlock	Schlage L463T x US26D
1	Permanent Core	Schlage (to suit) x US26D
2	Overhead Stops	Dorma 910S series x US26D
1	set Weatherstripping	Legacy Mfg. 5574CA jams/head
1	Astragal	Legacy Mfg. 774 x US32D
2	Door Bottoms	Legacy Mfg. 7763MA
1	Saddle	Legacy Mfg. (as detailed)

Note:

Furnish extended cylinder to suit cladding detail.

HARDWARE SET # 4

Each to have:

	Hinges	Stanley (as required) x US26D
1	Storeroom Lock	Schlage ND80-ATH x US26D
1	Permanent Core	Schlage (to suit) x US26D
1	Closer	Dorma 8916-AF x 689
1	Stop	Trimco 1201 x US32D
3	Silencers	Trimco 1229A

HARDWARE SET # 5

Each to have:

	Hinges	Stanley (as required) x US26D
1	Storeroom Lock	Schlage ND80-ATH x US26D
1	Permanent Core	Schlage (to suit) x US26D
1	Stop	Trimco 1201 x US32D
3	Silencers	Trimco 1229A

HARDWARE SET # 6 THRU HARDWARE SET #9
NOT USED

HARDWARE SET # 10

Each to have:

1	set Pivots	Rixson 147 x 3/4" Offset x US26D
1	Intermediate Pivot	Rixson M19 x 3/4" Offset x US26D
1	Exit Device	Von Duprin 98L-02 x US26D
1	Masterkeyed Cylinder	Schlage (to suit) x US26D
1	Temporary Core	Schlage (to suit) x US26D
1	Permanent Core	Schlage (to suit) x US26D
1	Closer/Stop	Dorma 8916-DS x 689
1	set Weatherstripping	Legacy Mfg. 5924MA jambs/head
1	Door Bottom	Legacy Mfg. 7553MA
1	Saddle	Pemko (as detailed)

HARDWARE SET # 11

Each to have:

	Hinges	Stanley (see description) x US26D
1	Office Lock	Schlage ND50-ATH x US26D
1	Permanent Core	Schlage (to suit) x US26D
1	Closer/Stop	Dorma 8916-DS x 689
1	set Gasketing	Legacy Mfg. 5924MA jambs/head
1	Door Bottom	Legacy Mfg. 7553MA
1	Saddle	Pemko (as detailed)

HARDWARE SET # 11A

Each to have:

	Hinges	Stanley (see description) x US26D
1	Office Lock	Schlage ND50-ATH x US26D
1	Permanent Core	Schlage (to suit) x US26D
1	Closer	Dorma 8916-AF x 689
1	Stop	Trimco 1270WV x US32D
1	set Gasketing	Legacy Mfg. 5823CA jambs/head
1	Door Bottom	Legacy Mfg. 7553MA
1	Saddle	Pemko (as detailed)

HARDWARE SET # 12

Each to have:

	Hinges	Stanley (see description) x US26D
1	Storeroom Lock	Schlage ND80-ATH x US26D
1	Permanent Core	Schlage (to suit) x US26D
1	Closer	Dorma 8916-AF x 689
1	Stop	Trimco 1270WV x US32D
1	set Weatherstripping	Legacy Mfg. 5574CA jambs/head
1	Door Bottom	Legacy Mfg. 7553MA
1	Saddle	Pemko (as detailed)

HARDWARE SET # 12A

Each to have:

	Hinges	Stanley (see description) x US26D
1	Storeroom Lock	Schlage ND80-ATH x US26D
1	Permanent Core	Schlage (to suit) x US26D
1	Closer/Stop	Dorma 8916-DS x 689
1	set Weatherstripping	Legacy Mfg. 5924MA jambs/head
1	Door Bottom	Legacy Mfg. 7553MA
1	Saddle	Pemko (as detailed)

HARDWARE SET # 13

Each to have:

1	set Pivots	Rixson 147 x 3/4" Offset x US26D
1	Intermediate Pivot	Rixson M19 x 3/4" Offset x US26D
1	Deadlock	Schlage L460T x US26D
1	Permanent Core	Dorma (to suit) x US26D
1	set Full Height Push Pulls	Rockwood RM3410 x BTB x US32D
1	Closer/Stop	Dorma 8916-SDS x 689
1	set Weatherstripping	(by door/frame manufacturer)
1	Saddle	Pemko (as detailed)

HARDWARE SET # 14

Each to have:

1	set Pivots	Rixson 147 x 3/4" Offset x US26D
1	Intermediate Pivot	Rixson M19 x 3/4" Offset x US26D
1	Deadlock	Schlage L463T x US26D
1	Permanent Core	Schlage (to suit) x US26D
1	set Push Pulls	Trimco 1894-4B x US32D
1	Closer	Dorma 8916-AF x 689
1	Stop	Trimco 1201 x US32D
1	set Weatherstripping	Legacy Mfg. 5823CA jambs/head
1	Door Bottom	Legacy Mfg. 7553MA
1	Saddle	Legacy Mfg. (as detailed)

HARDWARE SET # 15

Each to have:

	Hinges	Stanley (see description) x US26D
1	Office Lock	Schlage ND50-ATH x US26D
1	Permanent Core	Schlage (to suit) x US26D
1	Stop	Trimco 1201 x US32D
3	Silencers	Trimco 1229A

HARDWARE SET # 15A

Each to have:

	Hinges	Stanley (see description) x US26D
1	Office Lock	Schlage ND50-ATH x US26D
1	Permanent Core	Schlage (to suit) x US26D
1	Closer	Dorma 8916-AF x 689
1	Stop	Trimco 1201 x US32D
3	Silencers	Trimco 1229A

HARDWARE SET # 15B

Each to have:

	Hinges	Stanley (see description) x US26D
1	Office Lock	Schlage ND50-ATH x US26D
1	Permanent Core	Schlage (to suit) x US26D
1	Closer	Dorma 8916-AF x 689
1	Stop	Trimco 1270WV x US32D
1	set Gasketing	Legacy Mfg. 5884S-BK jambs/head

HARDWARE SET # 16

Each to have:

	Hinges	Stanley (see description) x US26D
1	Privacy Set	Schlage ND40-ATH x US26D
1	Permanent Core	Schlage (to suit) x US26D
1	Overhead Stop	Dorma 710S x US26D
3	Silencers	Trimco 1229A

HARDWARE SET # 16A

Each to have:

	Hinges	Stanley (see description) x US26D
1	Spring Hinge	Stanley 2060 (to match) x US26D
1	Privacy Set	Schlage L9496T-07A x US26D
1	Permanent Core	Schlage (to suit) x US26D
1	Overhead Stop	Dorma 710S series x US26D
3	Silencers	Trimco 1229A

HARDWARE SET # 16B

Each to have:

	Hinges	Stanley (see description) x US26D
1	Spring Hinge	Stanley 2060 (to match) x US26D
1	Privacy Set	Schlage L9496T-07A x US26D
1	Permanent Core	Schlage (to suit) x US26D
1	Stop	Trimco 1270WV x US32D
3	Silencers	Trimco 1229A

HARDWARE SET # 16C

Each to have:

	Hinges	Stanley (see description) x US26D
1	Privacy Set	Schlage ND40-ATH x US26D
1	Permanent Core	Schlage (to suit) x US26D
1	Stop	Trimco 1270WV x US32D
3	Silencers	Trimco 1229A

HARDWARE SET # 17

Each to have:

	Hinges	Stanley (see description) x US26D
1	Storeroom Lock	Schlage ND80-ATH x US26D
1	Permanent Core	Schlage (to suit) x US26D
1	Closer/Stop	Dorma 8916-DS x 689
3	Silencers	Trimco 1229A

HARDWARE SET # 17A

Each to have:

	Hinges	Stanley (see description) x US26D
1	Storeroom Lock	Schlage ND80-ATH x US26D
1	Permanent Core	Schlage (to suit) x US26D
1	Stop	Trimco 1270WV x US32D
3	Silencers	Trimco 1229A

HARDWARE SET # 17B

Each to have:

	Hinges	Stanley (see description) x US26D
1	Storeroom Lock	Schlage ND80-ATH x US26D
1	Permanent Core	Schlage (to suit) x US26D
1	Closer	Dorma 8916-AF x 689
1	Stop	Trimco 1270WV x US32D
1	set Gasketing	Legacy Mfg. 5884S-BK jambs/head

HARDWARE SET # 18

Each to have:

	Hinges	Stanley (see description) x US26D
1	Exit Device	Von Duprin 98LNL-F-02 x US26D
1	Masterkeyed Cylinder	Schlage (to suit) x US26D
1	Temporary Core	Schlage (to suit) x US26D
1	Permanent Core	Schlage (to suit) x US26D
1	Closer/Stop	Dorma 8916-DS x 689
1	set Gasketing	Legacy Mfg. 5884S-BK jambs/head

HARDWARE SET # 18A

Each to have:

	Hinges	Stanley (see description) x US26D
1	Exit Device	Von Duprin 98LBE-02 x US26D
1	Closer	Dorma 8916-AF x 689
1	Stop	Trimco 1201 x US32D
3	Silencers	Trimco 1229A

HARDWARE SET # 19

Each to have:

	Hinges	Stanley (see description) x US26D
1	Classroom Lock	Schlage ND70-ATH x US26D
1	Permanent Core	Schlage (to suit) x US26D
1	Closer	Dorma 8916-AF x 689
1	Stop	Trimco 1201 x US32D
3	Silencers	Trimco 1229A

HARDWARE SET # 19A

Each to have:

	Hinges	Stanley (see description) x US26D
1	Classroom Lock	Schlage ND70-ATH x US26D
1	Permanent Core	Schlage (to suit) x US26D
1	Stop	Trimco 1201 x US32D
3	Silencers	Trimco 1229A

HARDWARE SET # 19B

Each to have:

	Hinges	Stanley (see description) x US26D
1	Classroom Lock	Schlage ND70-ATH x US26D
1	Permanent Core	Schlage (to suit) x US26D
1	Closer/Stop	Dorma 8916-IS x 689
3	Silencers	Trimco 1229A

HARDWARE SET # 20

Each to have:

	Hinges	Stanley (see description) x US26D
1	set Push Pulls	Trimco 1894-4B x US32D
1	Closer	Dorma 8916-AF x 689
1	Stop	Trimco 1201 x US32D
3	Silencers	Trimco 1229A

END OF SECTION

SECTION 088000 - GLAZING

PART 1 - GENERAL

1.1 SUMMARY

- A. Work of this Section includes glazing for the following applications, including those specified in other Sections where glazing requirements are specified by reference to this Section:
 - 1. Window walls/storefront.
 - 2. Doors.
 - 3. Monolithic mirrors.
- B. Related Documents and Sections: Examine Contract Documents for requirements that directly affect or are affected by Work of this Section. Other Documents and Sections that directly relate to work of this Section include, but are not limited to:
 - 1. General provisions of the Contract, including General and Supplementary Conditions, and Division 01 General Requirements Specification Sections.
 - 2. Section 079200 - JOINT SEALANTS.
 - 3. Section 081113 - HOLLOW METAL DOORS AND FRAMES.
 - 4. Section 084000 - ALUMINUM FAÇADE SYSTEMS.

1.2 SYSTEM DESCRIPTION

- A. Performance Requirements:
 - 1. Fire-rated clear vision laminated clear and wireless glazing material for use in impact safety-rated locations such as doors, transoms and borrowed lites with fire rating requirements ranging from 20 minutes to 3 hours with hose stream test.
 - 2. Passes positive pressure test standards UL10C, UBC 7-2 and UBC 7-4.
 - 3. Provides protection from radiant and conductive heat transfer in accordance with ASTM E119 requirements.
- B. Warranty Requirements:
 - 1. Manufacturer's Special Warranty on Laminated Glass: Manufacturer's standard form in which laminated-glass manufacturer agrees to replace laminated-glass units that deteriorate within specified warranty period. Deterioration of laminated glass is defined as defects developed from normal use that are not attributed to glass breakage or to maintaining and cleaning laminated glass contrary to manufacturer's written instructions. Defects include edge separation, delamination materially obstructing vision through glass, and blemishes exceeding those allowed by referenced laminated-glass standard.
 - a. Warranty Period: 10 years from date of Substantial Completion.

1.3 SUBMITTALS

- A. Submit complete range of samples of standards colors and patterns for ceramic frits at insulating glass.
 - 1. Submit digital files of frit patterns for review.
- B. Verification Samples: Submit 12-inch x 12-inch samples of each type of glass indicated, including each variety of custom patterned glass, and 12-inch long samples of each color required, except black, for each type of sealant or gasket exposed to view. All samples shall bear the name of the manufacturer, brand name, thickness, and quality.
- C. Calculations: Provide wind load charts, calculations, thermal stress analysis, and certification of performance of this work. Indicate how design requirements for loading and other performance criteria have been satisfied. Document shall be signed and sealed by a Professional Engineer licensed in the State of North Carolina.
- D. Test Reports: Provide certified reports for specified tests.
- E. Warranties: Provide written warranties as specified herein.

1.4 QUALITY ASSURANCE

- A. Qualifications:
 - 1. Manufacturers: Fabrication processes, including low emissivity and reflective coatings, insulating, laminated, silk-screening and tempering shall be manufactured by a single manufacturer with a minimum of ten (10) years of fabrication experience and meet ANSI / ASQC 9002 1994.
- B. Publications: Comply with recommendations in the publications below, except where more stringent requirements are indicated. Refer to these publications for glazing terms not otherwise defined in this section or in Article 1.2 References.
 - 1. GANA Glazing Manual
 - 2. GANA Engineering Standards Manual
 - 3. GANA Laminated Glazing Reference Manual

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Deliver materials and products in unopened factory labeled packages. Store and handle in strict compliance with manufacturer's instructions and recommendations. Protect from damage, moisture and direct sunlight. Sequence deliveries to avoid delays, but minimize on-site storage.
 - 1. Manufacturers, fabricators, suppliers and shippers shall provide least amount of packaging that adequately and properly protects, supports and contains the items shipped, and is reusable, returnable or recyclable.
 - 2. Mark products with Shop Drawing location reference, unless already properly marked.

- a. Use removable tags or concealed markings.

1.6 WARRANTIES

- A. Provide written 10-year warranty from date of manufacture for laminated glass. Warranty covers deterioration due to normal conditions of use and not to handling, installing, and cleaning practices contrary to the glass manufacturer's published instructions.
- B. Provide a written 10-year warranty from date of manufacture for insulating glass. Warranty covers deterioration due to normal conditions of use and not to handling, installing, protecting and maintaining practices contrary to the glass manufacturer's published instructions.
- C. Provide a written 10-year warranty from date of manufacture for ceramic frit. Warranty covers deterioration due to normal conditions of use and not to handling, installing, protecting and maintaining practices contrary to the glass manufacturer's published instructions.
- D. Provide a written 5-year warranty from date of manufacture for fully tempered glass that has been Heat Soaked. Warrants that heat soaked tempered glass will not break spontaneously as a result of Nickel Sulfide (NiS) inclusions at a rate exceeding 0.5% (5/1000) for a period of five years from the date of manufacture.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. General: Provide glazing systems capable of withstanding normal thermal movement and wind and impact loads (where applicable) without failure, including loss or glass breakage attributable to the following: defective manufacture, fabrication, and installation; failure of sealants or gaskets to remain watertight and airtight; deterioration of glazing materials; or other defects in construction.
 1. Performance Requirements for all glass types:
 - a. Exterior Reflectance: 20% maximum
 - b. U-Value: 0.45
 - c. SHGC: PF < 0.25
- B. Glass Design: Glass thickness indicated on drawings and/or specified herein are minimums and are for detailing only. Confirm glass thickness by analyzing Project loads and in-service conditions. Provide glass lites for various size openings in nominal thicknesses indicated, but not less than thicknesses and in strengths (annealed or heat treated) required to meet or exceed the following criteria:
 1. Glass Thicknesses: Select minimum glass thickness to comply with ASTM E 1300.
 2. Probability of Breakage for Vertical Glazing:
 - a. 8 lites per 1000 for lites set vertically or not more than 15 degrees off vertical and under wind action.

- b. 1 lite per 1000 for lites installed 15 degrees from the vertical and under wind action.
 - c. Load Duration: 60 seconds or less.
 - 3. Maximum Lateral Deflection: For glass supported on all four edges, provide thickness required that limits center deflection at design wind pressure to 1/100 times the short side length or 1/2", whichever is less.
 - 4. Thermal Movements: Provide glazing that allows for thermal movements resulting from the following maximum change (range) in ambient and surface temperatures acting on glass framing members and glazing components. Base engineering calculation on surface temperatures of materials due to both solar heat gain and nighttime-sky heat loss.
 - a. Temperature Change (Range): 120 deg. F ambient; 180 deg. F, material surfaces.
 - 5. Thermal Solar Performance: See Article 2.10 herein.
- C. Glass units shall be annealed, heat strengthened, fully tempered or laminated where required to meet wind load and safety glazing requirements, as shown, specified, or recommended by the glass fabricator, and as required by the prevailing Building Code.

2.2 MANUFACTURERS

- A. Subject to compliance with requirements, provide products of one of the following:
- 1. Basis-of-Design: Viracon.
 - 2. AGC Flat Glass North America, Inc.
 - 3. Guardian Industries Corp.
 - 4. Pilkington North America, Inc.
 - 5. PPG Industries, Inc.

2.3 GLASS PRODUCTS

- A. Float Glass: ASTM C1036, Type I (transparent flat glass), Quality-Q3; unless otherwise indicated.
- B. Heat-Treated Float Glass: ASTM C1048; Type I (transparent flat glass); Quality-Q3; of class, kind, and condition indicated.
- 1. Fabrication Process: By horizontal (roller-hearth) process with roll-wave distortion parallel to bottom edge of glass as installed, unless otherwise indicated.
 - 2. Provide Kind HS (heat-strengthened) float glass in place of annealed float glass where needed to resist thermal stresses induced by differential shading of individual glass lites and to comply with glass design requirements.
 - 3. For uncoated glass, comply with requirements for Condition A.
 - 4. For coated vision glass, comply with requirements for Condition C (other uncoated glass).
 - 5. Provide Kind FT (fully tempered) float glass in place of annealed or Kind HS (heat-strengthened) float glass where safety glass is indicated.

- C. Laminated Glass: ASTM C1172, and complying with other requirements specified and with the following:
 - 1. Construction: Laminate glass with one of the following to comply with interlayer manufacturer's written recommendations:
 - a. Polyvinyl butyral interlayer.
 - 1). For polyvinyl butyral interlayers, laminate lites in autoclave with heat plus pressure.
 - b. Ionoplast interlayer, .06".
 - 2. Interlayer Thickness: Provide thickness not less than that indicated and as needed to comply with requirements.
 - 3. Interlayer Color: Clear unless otherwise indicated.
 - 4. Laminating Process: Fabricate laminated glass to produce glass free of foreign substances and air or glass pockets.
- D. Low-Iron Glass: ASTM C1036, Type 1, Class 1, quality q3, low iron composition, soda lime glass with light aqua tint to match Architect's sample.

2.4 SEALED INSULATING GLASS UNITS

- A. General: Provide factory-assembled units consisting of sealed lites of glass separated by a dehydrated interspace filled with argon gas, and with other requirements specified for glass characteristics, air space, sealing system, sealant, spacer material, corner design and desiccant. Provide insulating glass units complying with and labeled with appropriate certification label of IGCC/IGMA Certification Program.

2.5 SILVERED FLAT GLASS MIRRORS

- A. Glass Mirrors, General: ASTM C 1503; manufactured using copper-free, low-lead mirror coating process.
- B. Clear Glass: Mirror Select Quality; ultraclear (low-iron) float glass with a minimum 91 percent visible light transmission.
 - 1. Nominal Thickness: 5.0 mm.

2.6 GLAZING GASKETS

- A. Dense Compression Gaskets: Molded or extruded gaskets of one of the materials indicated below, complying with standards referenced with name of elastomer indicated below, and of profile and hardness required to maintain watertight seal:
 - 1. Neoprene, ASTM C864.
 - 2. Santoprene, U.L MH17699; Advanced Elastomer Systems, L.P.
 - 3. EPDM, ASTM C864.
 - 4. Silicone, ASTM C1115.
 - 5. Thermoplastic polyolefin rubber, ASTM C1115.

- B. Soft Compression Gaskets: Extruded or molded, closed-cell, integral-skinned gaskets of one of the materials indicated below; complying with ASTM C509, Type II, black; and of profile and hardness required to maintain watertight seal:
 - 1. Neoprene.
 - 2. Santoprene.
 - 3. EPDM.
 - 4. Silicone.
 - 5. Thermoplastic polyolefin rubber.
- C. Lock-Strip Gaskets: Neoprene extrusions in size and shape indicated, fabricated into frames with molded corner units and zipper lock-strips, complying with ASTM C542, black.

2.7 GLAZING SEALANTS

- A. General: Provide products of type indicated, complying with the following requirements:
 - 1. Compatibility: Select glazing sealants that are compatible with one another and with other materials they will contact, including glass products, seals of insulating-glass units, and glazing channel substrates, under conditions of service and application, as demonstrated by sealant manufacturer based on testing and field experience.
 - 2. Suitability: Comply with sealant and glass manufacturers' written instructions for selecting glazing sealants suitable for applications indicated and for conditions existing at time of installation.
 - 3. Colors of Exposed Glazing Sealants: As selected by Architect from manufacturer's full range.
- B. Elastomeric Glazing Sealants: Comply with ASTM C920 and other requirements indicated for each liquid-applied chemically curing sealant specified, including those referencing ASTM C920 classifications for type, grade, class, and uses related to exposure and joint substrates.
- C. Glazing Sealants for Fire-Resistive Glazing Products: Identical to products used in test assemblies to obtain fire-protection rating.

2.8 GLAZING TAPES

- A. Back-Bedding Mastic Glazing Tapes: Preformed, butyl-based elastomeric tape with a solids content of 100 percent; non-staining and non-migrating in contact with nonporous surfaces; with or without spacer rod as recommended in writing by tape and glass manufacturers for application indicated; packaged on rolls with a release paper backing; and complying with ASTM C1281 and AAMA 800 for products indicated below:
 - 1. AAMA 804.3 tape, where indicated.
 - 2. AAMA 806.3 tape, for glazing applications in which tape is subject to continuous pressure.
 - 3. AAMA 807.3 tape, for glazing applications in which tape is not subject to continuous pressure.

- B. Expanded Cellular Glazing Tapes: Closed-cell, foam tapes; factory coated with adhesive on both surfaces; packaged on rolls with release liner protecting adhesive; and complying with AAMA 800 for the following types:
 - 1. Type 1, for glazing applications in which tape acts as the primary sealant.
 - 2. Type 2, for glazing applications in which tape is used in combination with a full bead of liquid sealant.

2.9 MISCELLANEOUS GLAZING MATERIALS

- A. General: Provide products of material, size, and shape complying with referenced glazing standard, requirements of manufacturers of glass and other glazing materials for application indicated, and with a proven record of compatibility with surfaces contacted in installation.
- B. Cleaners, Primers, and Sealers: Types recommended by sealant or gasket manufacturer.
- C. Setting Blocks: Elastomeric material with a Shore, Type A durometer hardness of 85, plus or minus 5.
- D. Spacers: Elastomeric blocks or continuous extrusions with a Shore, Type A durometer hardness required by glass manufacturer to maintain glass lites in place for installation indicated.
- E. Edge Blocks: Elastomeric material of hardness needed to limit glass lateral movement (side walking).
- F. Cylindrical Glazing Sealant Backing: ASTM C1330, Type O (open-cell material), of size and density to control glazing sealant depth and otherwise produce optimum glazing sealant performance.
- G. Perimeter Insulation for Fire-Resistive Glazing: Identical to product used in test assembly to obtain fire-resistance rating.

2.10 FABRICATION OF GLAZING UNITS

- A. Fabricate glazing units in sizes required to glaze openings indicated for Project, with edge and face clearances, edge and surface conditions, and bite complying with written instructions of product manufacturer and referenced glazing publications, to comply with system performance requirements.
- B. Clean-cut or flat-grind vertical edges of butt-glazed monolithic lites in a manner that produces square edges with slight kerfs at junctions with outdoor and indoor faces.
- C. Grind smooth, pencil-radius and polish exposed glass edges and corners.

2.11 GLASS TYPES

- A. Insulating Laminated Coated Ceramic Frit Translucent Glass GL-01

1. Basis of Design: Viracon VNE1-53 Insulating Laminated IGU
 - a. Exterior Glass Ply: 1/4" Clear (tempered, where required)
 - b. Ceramic Frit: Frit Pattern on #2 Surface.
 - 1). Color to be selected by Architect
 - 2). Pattern: Standard dot pattern
 - c. Coating: Low E Coating on #2 Surface
 - d. Space: 1/2" air space
 - e. Silicone: Black
 - f. Interior Glass Ply 1: 1/4" Clear
 - g. Interlayer: .030" ARCTIC SNOW PVB .060" Clear PVB
 - h. Interior Glass Ply 2: 1/4" Clear
 - i. Reflectance: Max. 20%
- B. Insulating Laminated Coated Custom Silk-screened Vision Glass GL-02
 1. Basis of Design: Viracon VNE1-53 Insulating Laminated IGU
 - a. Exterior Glass Ply: 1/4" Clear (tempered, where required)
 - b. Ceramic Frit: Frit Pattern on #2 Surface.
 - 1). Color to be selected by Architect
 - 2). Pattern: Custom pattern per digital file to be provided by Architect.
 - c. Coating: Low E Coating on #2 Surface
 - d. Space: 1/2" air space
 - e. Silicone: Black
 - f. Interior Glass Ply 1: 1/4" Clear
 - g. Interlayer: .045" Clear PVB .045" Clear PVB
 - h. Interior Glass Ply 2: 1/4" Clear
 - i. Reflectance: Max. 20%
- C. Insulating Laminated Coated Custom Silk-screened Translucent Glass GL-03
 1. Basis of Design: Viracon VNE1-53 Insulating Laminated IGU
 - a. Exterior Glass Ply: 1/4" Clear (tempered, where required)
 - b. Ceramic Frit: Frit Pattern on #2 Surface.
 - 1). Color to be selected by Architect
 - 2). Pattern: Custom pattern per digital file to be provided by Architect.
 - c. Coating: Low E Coating on #2 Surface
 - d. Space: 1/2" air space
 - e. Silicone: Black
 - f. Interior Glass Ply 1: 1/4" Clear
 - g. Interlayer: .030" ARCTIC SNOW PVB .060" Clear PVB
 - h. Interior Glass Ply 2: 1/4" Clear
 - i. Reflectance: Max. 20%

D. Insulating Laminated Coated Custom Silk-screened Translucent Glass GL-04

1. Basis of Design: Viracon VNE1-53 Insulating Laminated IGU
 - a. Exterior Glass Ply: 1/4" Clear (tempered, where required)
 - b. Ceramic Frit: Frit Pattern on #2 Surface.
 - 1). Color to be selected by Architect
 - 2). Pattern: Custom pattern per digital file to be provided by Architect.
 - c. Coating: Low E Coating on #2 Surface
 - d. Space: 1/2" air space
 - e. Silicone: Black
 - f. Interior Glass Ply 1: 1/4" Clear
 - g. Interlayer: .030" POLAR WHITE PVB .060" Clear PVB
 - h. Interior Glass Ply 2: 1/4" Clear
 - i. Reflectance: Max. 20%

E. Wire Mesh Glass GL-05:

1. 1/4" clear glass, ground and polished both sides, with embedded 3/4" x 3/4" diamond pattern electrically welded steel wire mesh

F. Insulating Laminated Coated Spandrel Glass GL-06

1. Basis of Design: Viracon VNE1-53 Insulating Laminated IGU
 - a. Exterior Glass Ply: 1/4" Clear (tempered, where required)
 - b. Ceramic Frit: Frit Pattern on #2 Surface.
 - 1). Color to be selected by Architect
 - 2). Pattern: Custom pattern per digital file to be provided by Architect.
 - c. Coating: Low E Coating on #2 Surface
 - d. Space: 1/2" air space
 - e. Silicone: Black
 - f. Interior Glass Ply 1: 1/4" Clear
 - g. Coating: Spandrel coating on #4 surface
 - h. Interlayer: .030" ARCTIC SNOW PVB .060" Clear PVB
 - i. Interior Glass Ply 2: 1/4" Clear
 - j. Reflectance: Max. 20%

PART 3 - EXECUTION

3.1 PROJECT CONDITIONS

- A. Environmental Limitations: Do not proceed with glazing when ambient and substrate temperature conditions are outside limits permitted by glazing material manufacturers and when glazing channel substrates are wet from rain, frost, condensation, or other causes.

1. Do not install liquid glazing sealants when ambient and substrate temperature conditions are outside limits permitted by glazing sealant manufacturer or below 40 deg F.

3.2 EXAMINATION

- A. Examine framing glazing, with Installer present, for compliance with the following:
 1. Manufacturing and installation tolerances, including those for size, squareness, and offsets at corners.
 2. Presence and functioning of weep system.
 3. Minimum required face or edge clearances.
 4. Effective sealing between joints of glass-framing members.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.3 PREPARATION

- A. Clean glazing channels and other framing members receiving glass immediately before glazing. Remove coatings not firmly bonded to substrates.

3.4 GLAZING, GENERAL

- A. Comply with combined written instructions of manufacturers of glass, sealants, gaskets, and other glazing materials, unless more stringent requirements are indicated, including those in referenced glazing publications.
- B. Glazing channel dimensions, as indicated on Drawings, provide necessary bite on glass, minimum edge and face clearances, and adequate sealant thicknesses, with reasonable tolerances. Adjust as required by Project conditions during installation.
- C. Protect glass edges from damage during handling and installation. Remove damaged glass from Project site and legally dispose of off Project site. Damaged glass is glass with edge damage or other imperfections that, when installed, could weaken glass and impair performance and appearance.
- D. Apply primers to joint surfaces where required for adhesion of sealants, as determined by preconstruction sealant-substrate testing.
- E. Install setting blocks in sill rabbets, sized and located to comply with referenced glazing publications, unless otherwise required by glass manufacturer. Set blocks in thin course of compatible sealant suitable for heel bead.
- F. Do not exceed edge pressures stipulated by glass manufacturers for installing glass lites.
- G. Provide spacers for glass lites where length plus width is larger than 50 inches as follows:
 1. Locate spacers directly opposite each other on both inside and outside faces of

- glass. Install correct size and spacing to preserve required face clearances, unless gaskets and glazing tapes are used that have demonstrated ability to maintain required face clearances and to comply with system performance requirements.
2. Provide 1/8 inch minimum bite of spacers on glass and use thickness equal to sealant width. With glazing tape, use thickness slightly less than final compressed thickness of tape.
- H. Provide edge blocking where indicated or needed to prevent glass lites from moving sideways in glazing channel, as recommended in writing by glass manufacturer and according to requirements in referenced glazing publications.
 - I. Set glass lites in each series with uniform pattern, draw, bow, and similar characteristics.
 - J. Sealant: Provide dual seals (butyl-based primary seal and silicone secondary seal) on outside face and dry glaze interior face with pre-formed rubber gasket.
 - K. 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.
 - L. 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.

3.5 TAPE GLAZING

- A. Position tapes on fixed stops so that, when compressed by glass, their exposed edges are flush with or protrude slightly above sightline of stops.
- B. Install tapes continuously, but not necessarily in one continuous length. Do not stretch tapes to make them fit opening.
- C. Cover vertical framing joints by applying tapes to heads and sills first and then to jambs. Cover horizontal framing joints by applying tapes to jambs and then to heads and sills.
- D. Place joints in tapes at corners of opening with adjoining lengths butted together, not lapped. Seal joints in tapes with compatible sealant approved by tape manufacturer.
- E. Do not remove release paper from tape until just before each glazing unit is installed.
- F. Apply heel bead of elastomeric sealant.
- G. Center glass lites in openings on setting blocks and press firmly against tape by inserting dense compression gaskets formed and installed to lock in place against faces of removable stops. Start gasket applications at corners and work toward centers of openings.
- H. Apply cap bead of elastomeric sealant over exposed edge of tape.

3.6 GASKET GLAZING (DRY)

- A. Fabricate compression gaskets in lengths recommended by gasket manufacturer to fit openings exactly, with allowance for stretch during installation.
- B. Insert soft compression gasket between glass and frame or fixed stop so it is securely in place with joints miter cut and bonded together at corners.
- C. Center glass lites in openings on setting blocks and press firmly against soft compression gasket by inserting dense compression gaskets formed and installed to lock in place against faces of removable stops. Start gasket applications at corners and work toward centers of openings. Compress gaskets to produce a weathertight seal without developing bending stresses in glass. Seal gasket joints with sealant recommended by gasket manufacturer.
- D. Install gaskets so they protrude past face of glazing stops.

3.7 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.

3.8 LOCK-STRIP GASKET GLAZING

- A. Comply with ASTM C716 and gasket manufacturer's written instructions. Provide supplementary wet seal and weep system, unless otherwise indicated.

3.9 CLEANING AND PROTECTION

- A. Protect exterior glass from damage immediately after installation by attaching crossed streamers to framing held away from glass.
 - 1. Do not apply markers to glass surface.
 - 2. Remove nonpermanent labels without using a metal edged tool, and clean surfaces.
- B. Protect glass from contact with contaminating substances resulting from construction operations, including concrete, mortar and weld splatter.
 - 1. If, despite such protection, contaminating substances do come into contact with glass, remove substances immediately as recommended by glass manufacturer.
- C. Examine glass surfaces adjacent to or below exterior concrete and other masonry surfaces at frequent intervals during construction, but not less than once a month, for

buildup of dirt, scum, alkaline deposits, or stains; remove as recommended in writing by glass manufacturer.

- D. Remove and replace glass that is broken, chipped, cracked, or abraded or that is damaged from natural causes, accidents, and vandalism, during construction period.
- E. Wash glass on both exposed surfaces in each area of Project 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.
- F. At end of each workday, remove rubbish other discarded materials from Project site.
- G. Protect the work of other trades and work of this Section already installed against soiling and damage by the exercise of reasonable care and precautions. Repair or replace any work so damaged or soiled.

3.10 WASTE MANAGEMENT

- A. Separate and dispose of waste in accordance with the Project's Waste Management Plan.

END OF SECTION

SECTION 092900 - GYPSUM BOARD

PART 1 - GENERAL

1.1 SUMMARY

- A. Work of this Section includes gypsum board but is not limited to the following:
 - 1. Gypsum board and related materials.
 - 2. Impact-resistant gypsum board.
 - 3. Fire-rated gypsum assemblies.
 - 4. Preformed aluminum trims.
- B. Related Documents and Sections: Examine Contract Documents for requirements that directly affect or are affected by Work of this Section. Other Documents and Sections that directly relate to work of this Section include, but are not limited to:
 - 1. General provisions of the Contract, including General and Supplementary Conditions, and Division 01 General Requirements Specification Sections.
 - 2. Section 061053 - MISCELLANEOUS ROUGH CARPENTRY.
 - 3. Section 072100 - THERMAL INSULATION
 - 4. Section 079200 - JOINT SEALANTS.
 - 5. Section 081113 - HOLLOW METAL DOORS AND FRAMES
 - 6. Section 083113 - ACCESS DOORS AND FRAMES.
 - 7. Section 099100 - PAINTING

1.2 SYSTEM DESCRIPTION

- A. Contractor's Design:
 - 1. Engage the services of a Professional Engineer registered in the State of North Carolina to prepare complete shop drawings and structural design computations for work of this Section. Drawings and calculations shall bear the engineer's professional seal and signature.
 - a. Note: Manufacturer's shop drawings stamped by the engineer are acceptable instead of those actually prepared by the engineer.
 - 2. The structural design computations shall provide a complete structural analysis of all typical and special conditions of construction. Show how design load requirements and other performance criteria have been satisfied and conform to the governing laws and building codes.
 - 3. The shop drawings shall show all pertinent details for fabrication and erection of each metal fabrication indicated. Include plans, elevations, sections, and details of metal fabrications and their connections. Show anchorage and accessory items.
 - 4. Provide templates for anchors and bolts specified for installation under other Sections.

1.3 SUBMITTALS

A. Action Submittals:

1. Product and System Data: Manufacturer's product literature, test reports and installation instructions.
2. Shop Drawings: Submit fabrication and assembly drawings indicating materials, piece quantities and dimensions, each piece surface finish, assembly configuration, erection sequence, piece numbering, specific attachments and attachment requirements.
 - a. Engage the services of a Professional Engineer registered in the State of North Carolina to prepare complete shop drawings and structural design computations for work of this Section. Drawings and calculations shall bear the engineer's professional seal and signature.
 - b. Field Measurements: Take necessary field measurements prior to preparation of Shop Drawings.
 - 1). Record measurements on Shop Drawings.

B. Informational Submittals:

1. Quality Assurance Submittals:
 - a. Test Reports: Submit certified test results by a recognized testing laboratory in accordance with specified test methods for each product and/or system indicating physical, chemical and performance characteristics.
 - b. Certificates: Submit with manufacturer's signature certifying that each product and/or system meets the requirements of the performance characteristics, physical criteria, and applicable standards specified.
 - c. Manufacturer's Instructions: Installation of fire rated systems.
 - d. Qualification Statements: Submit a letter, on printed letterhead and signed by an officer of the firm, for each listed quality assurance qualification listed, attesting to meeting each requirement called out.
 - e. Submit certification of manufacturer compliance with fire and sound requirements indicated.
 - f. Evaluation Reports: Submit evaluation reports certified under an independent third party inspection program administered by an agency accredited by IAS to ICC-ES AC98, IAS Accreditation Criteria for Inspection Agencies.

1.4 QUALITY ASSURANCE

A. Qualifications:

1. Manufacturer Qualifications: A firm experienced a minimum five (5) years in manufacturing products or systems similar to those indicated for this Project and with a record of successful in-service performance.
2. Installer Qualifications: Perform installation with skilled, experienced and trained workmen supervised by trained personnel who shall have at least three (3) years successful experience in installations of similar size and scope.

- B. Fire Resistance Rated Assemblies: Where indicated, provide materials and construction identical to those tested in accordance to ASTM E119 and UL 263 by an independent testing and inspection agency acceptable to AHJ.
 - 1. Fire Resistance Ratings: Indicated by design designations from UL "Fire Resistance Directory.
- C. STC-Rated Assemblies: Provide materials and construction methods complying with ASTM E90 with performance results as defined by ASTM E413.
- D. Pre-installation Meeting: Purpose is to review installation procedures and warranty requirements.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Deliver all manufactured materials to site in original packages, containers, or bundles bearing the manufacturer's name and brand names, type of material, and contents.
- B. Store materials in interior spaces, above floors, under cover, away from sweating walls and other damp surfaces, and with good ventilation.
- C. Handle gypsum boards to prevent damage to edges, ends, or surfaces. Protect metal corner beads, casing beads, and trim from being bent or damaged.

1.6 WARRANTY

- A. Contractor shall warrant installation for a period of two (2) years.
- B. Warranty: Furnish two (2) year written warranty signed by the manufacturer and installer agreeing to repair or replace work which has failed as a result of defects in materials or workmanship. Upon notification within the warranty period, such defects shall be repaired at no cost to the Owner.

PART 2 - PRODUCTS

2.1 SYSTEM PERFORMANCE REQUIREMENTS

- A. Fire resistance ratings required for gypsum board assemblies specified in this section are shown or scheduled on the Drawings.
- B. Sound transmission ratings required for gypsum board assemblies specified in this section are shown or scheduled on the Drawings. For gypsum board assemblies indicated to have STC ratings, provide materials and construction identical to those of assemblies whose STC ratings were determined per ASTM E 90 and classified per ASTM E 413 by a qualified independent testing agency.
- C. Structural Performance: Stud depths and gauges shown or specified are minimum required. Select gauge of studs or decrease spacing, so that deflection under 5 lb load will not exceed the following, where L is the longest unbraced length. Compute sectional properties in accordance with AISI "Specification for Design of Cold-Formed

Steel Structural Members.”

1. Steel studs which will be faced with gypsum board: L/240.
 2. Steel studs which will receive finish of tile: L/360.
- D. Abuse Resistance: Where "abuse resistant" or "impact resistant" gypsum board is specified, furnish material that meet the performance specified below, based on testing of identical boards:
1. Abrasion Resistance, ASTM D 4977: Surface abrasion not more than 0.087 in. when tested with 25 lb. added weight, 50 cycles of abrasion.
 2. Indentation Resistance, ASTM D5420: When hit with a 0.5 inch (12.7 mm) diameter striker at 72-in-lbs. drop energy, panels shall display indentation of no more than 0.15 inch.
 3. Hard Body Impact Resistance: Force required to cause penetration into the stud cavity shall be no less than 80 foot-pounds when hit with a 2 in. steel pipe cap.
 - a. Impact-resistant installations at stair shafts shall consists of 2 layers of 5/8" impact-resistant gypsum board each of which meets or exceeds Hard Body Impact Classification Level 2 as measured by the test method described in ASTM C 1629/C 1629M on occupied side of partition.
 4. Soft-Body Resistance, ASTM E 695: Tested with panels installed over studs spaced 16 inches on center, minimum performance of panels shall be as follows:
 - a. Surface Failure: 180 ft.-lbs. minimum.
 - b. Deformation Failure (L/240): 240 ft.-lbs. minimum.
 - c. Penetration Failure: 300 ft. lbs., minimum.
 5. Soft-Body Resistance, ASTM E 695 Modified: Tested with panels installed over studs spaced 16 inches on center, with test protocol modified to repeatedly impact at a constant 12 in. drop height, panels shall evidence not surface failure, deformation failure, or penetration failure after 50 impacts.

2.2 GYPSUM BOARDS

- A. Gypsum Board: ASTM C1396:
1. Provide Type C boards of thickness and size as indicated on Drawings, or scheduled:
 - a. Size: 5/8 inch by 48 inches wide by length required to minimize cross joints.
 2. Regular: Tapered-edge gypsum panels.
 - a. Provide Type X gypsum panels at fire-rated assemblies, or where noted on Drawings.
- B. Sustainable Interior Gypsum Board: ASTM C 1396/C 1396M: Type X, UL Classified: ULIX.
1. Basis of Design: EcoSmart Panels Firecode® X by United States Gypsum Company, LLC.
 2. ISO 14040 Environmental Management, Life Cycle Assessment, Principles and Framework:

- a. Carbon emissions limit per Gypsum Association; Industry Standard Type III EPD for North American type X wallboard with a manufacturing Global Warming Potential of 215 kg CO₂ / 1000 ft².
 - b. Water reduction per Gypsum Association; Industry Standard Type III EPD for North American type X wallboard having a manufacturing Virtual Water of 0.76 m³ / 1000 ft².
 - c. Primary Energy from non-renewable resources: 3435 MJ / 1000 ft².
 3. UL Type Designation "ULIX".
 4. Size: 5/8 inch by 48 inches wide by length required to minimize cross joints.
 - a. Long Edges: Tapered.
 5. Performance:
 - a. ASTM E136 Non-combustibility: Meets or exceeds criteria.
 - b. ASTM E84 Surface-Burning Characteristics:
 - 1). Flame Spread: 15.
 - 2). Smoke Developed: 5.
 - 3). Classification: Class A.
 - c. ASTM C473:
 - 1). Core Hardness: Meets or Exceeds 11 (ASTM C473 B)
 - 2). Flexural Strength (lbft).
 - a). Parallel: Not less than 46.
 - b). Perpendicular: Not less than 147.
 - 3). Nail Pull Resistance (lbft) ASTM C473 (B): Not less than 87.
- C. Drywall for High Moisture Areas:
 1. Provide one of the following:
 - a. Glass-Mat Interior Gypsum Board: ASTM C 1658, with fiberglass mat laminated to both sides; specifically designed for interior use.
 - 1). Core: 5/8 inch, Type X.
 - 2). Long Edges: Tapered.
 - 3). Mold Resistance: ASTM D 3273, score of 10 as rated according to ASTM D 3274.
 - b. Moisture- and Mold-Resistant Gypsum Board: ASTM C 1396/C 1396M. With moisture- and mold-resistant core and paper surfaces.
 - 1). Core: 5/8 inch, Type X.
 - 2). Long Edges: Tapered.
 - 3). Mold Resistance: ASTM D 3273, score of 10 as rated according to ASTM D 3274.
 2. Locations: Provide at all toilet rooms and other wet areas.
- D. Impact-Resistant Gypsum Wallboard: ASTM C 36 or ASTM C 1396, ASTM C 1278, core type as required by fire resistance rated assembly indicated and with tapered edges.
 1. Products: Subject to compliance with requirements, provide one of the following 5/8

inch thick panels:

- a. FIBEROCK Abuse-Resistant Interior Panels, by United States Gypsum Company.
 - b. Sheetrock Mold Tough VHI by USG.
 - c. Protecta AR 100 Type X with Mold Defense by Continental Building Products.
2. Locations: Including but not limited to mechanical rooms, fire stairs, and other locations required by code.
 3. Refer to performance requirements herein, and the following:
 - a. Abrasion Resistance per ASTM C1629: Level 1.
 - b. Indentation Resistance per ASTM C1629: Level 1.
 - c. Soft-Body Impact Resistance per ASTM C1629: Level 2.
 - d. Hard-Body Impact Resistance per ASTM C1629: Level 3.
 4. Impact resistant gypsum board, when tested in accordance with ASTM E84, shall have a flame spread rating of 25 or less and a smoke developed rating of 50 or less.

E. Tile Backing Panels:

1. Provide the following:
 - a. Glass-Mat, Water-Resistant Backing Board: ASTM C 1178, with manufacturer's standard edges.
2. Mold Resistance: ASTM D 3273, score of 10 as rated according to ASTM D 3274.
3. Locations: Substrate for all wall tile installations and other locations indicated.

2.3 FASTENERS

- A. Self-drilling screws conforming to ASTM C1002, of type indicated for substrate, provide lengths recommended by manufacturer.
1. Gypsum Wallboard to Steel Framing and Furring Members: Type S, bugle head screws with bugle-type Phillips-head.
 2. Gypsum Wallboard to Wood Blocking: Type W with bugle-type Phillips-head.
 3. Tile Backing Panels: Use corrosion-resistant screws of type and size recommended by panel manufacturer.
- B. Sound Isolation Clips: Provide sound isolation clips for mounting of furring channels at locations indicated.
1. Basis-of-Design Product: Iso-Max Sound Isolation Clips by Kinetics Noise Control, Dublin, Ohio.
 2. Vertical Load Capacity: Clips shall have sufficient capacity to support wall or ceiling weights as constructed. In a vertical load test comparable to a ceiling installation, the clip shall have a minimum design load capacity of 36 lbs. using 25 gauge furring channel.
 3. Design Load Capacity: The minimum design load capacity when using 22 gauge furring channel shall be 48 lbs. Design load capacity shall be based on a safety factor where the load to failure, defined as pullout of the channel from the clip, is a minimum 2.5 times the allowable maximum Design Load. Anchors for attachment of

the clips to the substructure shall be selected to support wall and/or ceiling weights at each clip.

4. The isolation clips shall consist of a rubber element into which a standard galvanized steel furring channel, 7/8 in. x minimum 25 gauge, is captured. The channel legs snap fit into the rubber element without any metal-to-metal or other rigid contact with building elements.
5. The isolation clip is attached to the wall/ceiling framing or other structural substrate through galvanized steel brackets on each side of the rubber isolation element. The brackets shall be of sufficient strength to carry the wall or ceiling weight without bending or failure.

2.4 METAL TRIM AND ACCESSORIES

- A. General: Provide metal trim and accessories conforming to ASTM C840. Unless otherwise indicated, provide paper-faced trim and accessories.
- B. Corner Bead: 1 inch by 1 inch perforated flange, standard type, 26 gauge, galvanized steel, for compound finishing.

2.5 PREFORMED ALUMINUM TRIMS

- A. Manufacturers: Subject to compliance with requirements, provide products by the following:
 1. Gordon, Inc.
 2. Milgo-Bufkin.
 3. MM Systems Corporation.
 4. Pittcon Industries.
 5. Vlabizzuno.
 6. Architect acceptable equivalent.
- B. Custom Shaped Extrusions, Refer to Drawings:
 1. Scope: Including but not limited to floating base, ceiling reveals, corner reveals, and control joints.
 - a. 2 foot by 2 foot preformed corners with inter-locking pins to assure alignment.
 - b. Minimum Thickness: 1/8 inch.

2.6 FINISHING MATERIALS

- A. Joint Treatment Materials: Joint treatment materials shall conform to ASTM C474 and ASTM C475, as applicable.
 1. Laminating Adhesive and Joint Finishing Compound: As recommended by gypsum wallboard manufacturer, interior type for interior general use, exterior type for use at water resistant gypsum backer board.
 2. Joint Tape: 2 inches to 2-1/2 inches wide paper tape, as recommended by gypsum

wallboard manufacturer.

- B. Metal Deck Filler: Of type approved by Local Authorities having jurisdiction. Provide filler at metal deck where partitions contact the deck perpendicular to deck.

2.7 ACOUSTICAL MATERIALS

- A. Sound Attenuation Blankets: ASTM C665, Type I (blankets without membrane facing) produced by combining thermosetting resins with mineral fibers manufactured from slag wool or rock wool.
 - 1. Fire-Resistance-Rated Assemblies: Comply with mineral-fiber requirements of assembly.
 - 2. Recycled Content: Provide blankets with recycled content such that post-consumer recycled content plus one-half of pre-consumer recycled content constitutes a minimum of 50 percent by weight.
- B. Acoustical Sealant for Concealed Applications: Provide "BA-98 Permanently non-hardening Acoustical Sealant", manufactured by Pecora Chemical Corp., equivalent product manufactured by U.S. Gypsum Co., National Gypsum Co., or approved equal.
- C. Acoustical Sealant for Exposed Applications: Provide paintable "AC-20 Acrylic Latex Caulk", manufactured by Pecora Chemical Corp., equivalent product manufactured by DAP or Gibson Homans Co., or approved equal.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Inspect job conditions and related Work and report to Architect in writing, all conditions interfering with the proper installation of Work of this Section. Commencement of Work in any given area shall constitute acceptance of conditions in that area as acceptable to receive Work of this Section.

3.2 GENERAL REQUIREMENTS

- A. Provide Work conforming to published specifications and installation instructions of each manufacturer, the approved shop drawings, above-referenced quality assurance standards, the governing laws and code.
- B. Erect gypsum drywall Work, rigidly supported, and securely fastened in place, in such a manner that plumb, level, and true finished lines and surfaces will result in the finished Work in accordance with the requirements of ASTM C754 and ASTM C840.
- C. Construct gypsum drywall Work only after all windows and door openings are enclosed and a temperature of not less than 55 Deg F is maintained during and up to completion of the drywall Work.

3.3 FIRE-RATED GYPSUM ASSEMBLIES

- A. Where fire-rated construction is indicated, provide materials and application methods in accordance with the specifications contained in UL Fire Resist Directory for the Design Number(s) indicated by authorities having jurisdiction (AHJ).
 - 1. Refer to Drawings to determine location of fire-resistive, fire-protective, and acoustically-rated Work, and construct this Work to conform to the specifications and installation instructions of UL or other testing agency(ies).
 - 2. Refer to the Drawings to determine the number of layers of gypsum board, thickness of board, etc., for each of the installations.
 - 3. Joints of fire-rated gypsum board enclosures shall be closed and sealed in accordance with UL test requirements or GA requirements.
 - 4. Seal penetrations through rated partitions and ceilings tight in accordance with tested systems.
 - 5. Fill wall cavities with 2.5 lb/cu.ft density mineral fiber insulation unless indicated otherwise.

3.4 ACOUSTICAL INSULATION

- A. Install sound-attenuating blankets where indicated. Provide materials and construction methods identical to those tested in assembly indicated according to ASTM E90 and classified according to ASTM E413 by an independent testing agency.

3.5 GYPSUM BOARD AND RELATED MATERIALS INSTALLATION

- A. Examination:
 - 1. Verify that framing and furring are securely attached and of sizes and spacing to provide a suitable substrate to receive gypsum board and cementitious backer units.
 - 2. Proceed with Work only after framing and furring are acceptable for application of gypsum board and cementitious backer units.
- B. Gypsum Wall Board: Install according to the most current versions of Gypsum Association Publication GA-216-2004 "Application and Finishing of Gypsum Panel Products" and ASTM C840, "Standard Specification for Application and Finishing of Gypsum Board for Non-Fire Rated Construction."
- C. Gypsum Base Installation: Unless otherwise indicated application of gypsum base shall conform to ASTM C844.

3.6 FINISHING OF GYPSUM BOARD

- A. Tape and finish gypsum board in accordance with ASTM C840 and GA-214:
 - 1. Provide joint, fastener depression, and corner treatment.
 - 2. Tool joints as smoothly as possible to minimize sanding and dust.
 - 3. Protect workers, building occupants, and HVAC systems from gypsum dust.

- B. Finish each concealed joint in wallboard above ceiling finishes flush with tape and a minimum of two coats of compound to provide a continuous, uninterrupted plane for acoustical and fire-resistive performance. Concealed joints may be left in rough condition without finish sanding.
- C. Apply gypsum board finish in accordance with manufacturer's published instructions and GA-214 Finish Levels.
 - 1. Level 0 for concealed surfaces which are not fire rated, smoke barriers, or plenums.
 - 2. Level 1 for concealed surfaces which are fire rated, smoke barriers,, or plenums.
 - 3. Level 2 under ceramic tile finish.
 - 4. Level 3 within mechanical rooms, machine rooms, electrical rooms, and non-occupied areas.
 - 5. Level 4: Finish for all finished spaces.
 - 6. Level 5: Not used.

3.7 CLEANING AND PROTECTION

- A. At end of each workday, remove rubbish other discarded materials from Project site.
- B. Protect the work of other trades and work of this Section already installed against soiling and damage by the exercise of reasonable care and precautions. Repair or replace any work so damaged or soiled.
- C. At completion of construction activities of other trades, touch up and restore damaged or defaced coated surfaces.

3.8 WASTE MANAGEMENT

- A. Separate and dispose of waste in accordance with the Project's Waste Management Plan.

END OF SECTION

SECTION 093000 - TILING

PART 1 - GENERAL

1.1 SUMMARY

- A. Work of this Section includes but is not limited to the following:
 - 1. Manufactured wall tile.
 - 2. Trim tiles as indicated on Drawings and as required for a complete installation.
 - 3. Installation materials.
- B. Related Documents and Sections: Examine Contract Documents for requirements that directly affect or are affected by Work of this Section. Other Documents and Sections that directly relate to work of this Section include, but are not limited to:
 - 1. General provisions of the Contract, including General and Supplementary Conditions, and Division 01 General Requirements Specification Sections.
 - 2. Section 079200 - JOINT SEALANTS.
 - 3. Section 092900 - GYPSUM BOARD.
- C. Extra Materials:
 - 1. Deliver extra materials to Owner. Furnish extra materials described below that match products installed, are packaged with protective covering for storage, and are identified with labels describing contents.
 - 2. Tile and Trim Units: Furnish quantity of full-size units equal to 2 percent of amount installed, for each type, composition, color, pattern, and size indicated.

1.2 SUBMITTALS

- A. Action Submittals:
 - 1. Product Data: Submit manufacturer's printed descriptions of materials, components and systems, performance criteria, use limitations, recommendations and installation information for each type of tile, mortar, grout, and other products specified.
 - 2. Shop Drawings: Submit fabrication and assembly drawings indicating materials, piece quantities and dimensions, each piece surface finish, assembly configuration, erection sequence, piece numbering, specific attachments, attachment requirements and the following:
 - a. Tile patterns and locations.
 - b. Widths, details, and locations of expansion, contraction, control, and isolation joints in tile substrates and finished tile surfaces.
 - 3. Tile Samples for Initial Selection: Manufacturer's color charts consisting of actual tiles or sections of tiles showing the full range of colors, textures, and patterns

available for each type and composition of tile indicated. Include Samples of accessories involving color selection.

4. Grout Samples for Initial Selection: Manufacturer's color charts consisting of actual sections of grout showing the full range of colors available for each type of grout indicated.
5. Samples for Verification: Of each item listed below, prepared on Samples of size and construction indicated. Where products involve normal color and texture variations, include Sample sets showing the full range of variations expected.
 - a. Each type and composition of tile and for each color and texture required, at least 12 inches square, mounted on braced cementitious backer units, and with grouted joints using product complying with specified requirements and approved for completed work in color or colors selected by Architect.
 - b. Full-size units of each type of trim and accessory for each color required.

B. Informational Submittals:

1. Quality Assurance Submittals:
 - a. Test Reports: Submit certified test results by a recognized testing laboratory in accordance with specified test methods for each product and/or system indicating physical, chemical and performance characteristics.
 - b. Certificates: Submit with manufacturer's signature certifying that each product and/or system meets the requirements of the performance characteristics, physical criteria, and applicable standards specified.
 - c. Manufacturer's Instructions: Installation.
 - d. Qualification Statements: Submit a letter, on printed letterhead and signed by an officer of the firm, for each listed quality assurance qualification listed, attesting to meeting each requirement called out.

1.3 QUALITY ASSURANCE

A. Qualifications:

1. Manufacturer Qualifications: A firm experienced a minimum five (5) years in manufacturing products or systems similar to those indicated for this Project and with a record of successful in-service performance.
 - a. Manufacturer shall have resources to provide products from the same production run for each contiguous area of consistent quality in appearance and physical properties without delaying the Work.
2. Installer Qualifications: Perform installation with skilled, experienced and trained workmen supervised by trained personnel who shall have at least three (3) years successful experience in installations of similar size and scope.

B. Single Source Responsibility:

1. Obtain each type and color tile material required from single source.
2. Obtain setting and grouting materials from one manufacturer to ensure compatibility and manufacturer's system warranty.

C. Pre-installation Meeting:

1. Purpose: To review installation procedures and warranty requirements.
2. Attendees: Architect, Contractor, Installer.
3. Agenda:

1.4 DELIVERY, STORAGE, AND HANDLING

- A. Deliver materials and products in unopened factory labeled packages. Store and handle in strict compliance with manufacturer's instructions and recommendations. Protect from damage, moisture and direct sunlight. Sequence deliveries to avoid delays, but minimize on-site storage.
1. Manufacturers, fabricators, suppliers and shippers shall provide least amount of packaging that adequately and properly protects, supports and contains the items shipped, and is reusable, returnable or recyclable.
 2. Mark products with Shop Drawing location reference, unless already properly marked.
 3. Deliver and store packaged materials in original containers with seals unbroken and labels intact until time of use. Comply with requirement of ANSI A137.1 for labeling sealed tile packages.

1.5 WARRANTY

- A. Contractor shall warrant installation for a period of two (2) years.
- B. Contractor shall provide manufacturer's warranty against defective materials for a period of five (5) years commencing on Date of Substantial Completion.

PART 2 - PRODUCTS

2.1 GENERAL

- A. Manufactured tile shall conform with ANSI A137.1 with respect to abrasive wear, water absorption, bonding capability, thickness, facial dimensions, facial warpage, wedging, crazing, breaking strength and thermal shock, unless otherwise 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. Colors, Textures, and Patterns: Where manufacturer's standard products are indicated for tile, grout, and other products requiring selection of colors, surface textures, patterns, and other appearance characteristics, provide specific products or materials complying with the following requirements:

1. Provide Architect's selections from manufacturer's full range of colors, textures, and patterns for products of type indicated.
 2. Provide tile trim and accessories that match color and finish of adjoining flat tile.
- D. Factory Blending: For tile exhibiting color variations within the ranges selected during Sample submittals, blend tile in the factory and package so tile units taken from one package show the same range in colors as those taken from other packages and match approved Samples.

2.2 TILE PRODUCTS

- A. Tile complying with ANSI A137.1 as selected by Architect.
- B. Tile Types: Refer to the Material Schedule on the Drawings.
- C. Include special shapes, including cove bases, bullnose edges, corners, etc., required to complete the work according to best trade practice for each job condition, whether or not such special shapes are specifically indicated or specified.

2.3 INSTALLATION MATERIALS

- A. Trims: Provide outside corners, tile top trim, and transitions strips as indicated on Drawings and or required for a complete installation by Schluter Systems.
- B. Latex-Portland Cement Mortar; Thin-Set:
1. Pre-packaged dry-mortar mix containing dry, re-dispersible, ethylene vinyl acetate additive to which only water must be added at jobsite. Mix water according to mortar manufacturer's directions.
 2. Porcelain Installations: Meet requirements of ANSI A118.11.
 3. Ceramic Tile Installations: Meet requirements of ANSI A118.4:
 - a. Basis-of-Design Product: Laticrete / 254 Platinum.
- C. Polymer Modified Grout: ANSI A118.7:
1. Basis-of-Design Product: Laticrete / Permacolor.
 - a. Color: As selected by Architect from manufacturer's full range of colors.
- D. Water-Cleanable Epoxy Grout: ANSI A118.3.
1. Basis-of-Design Product: Mapei Kerapoxy.
 - a. Color: Refer to the Finish Schedule on the Drawings.

2.4 NON-CERAMIC TRIM

- A. Non-Ceramic Trim: Satin natural anodized extruded aluminum, style and dimensions to suit application, for setting using tile mortar or adhesive; use in the following locations:
1. Edge-protection and transition profiles:

- a. Basis of Design: Schluter-JOLLY, Anodized Aluminum. Provide this product, or acceptable equivalent by one of the following:
 - 1). Ceramic Tool Company.
 - 2). Blanke Corporation.

2.5 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.

2.6 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. Sealants shall have a VOC content of 250 g/L or less when calculated according to 40 CFR 59, Subpart D.
- B. Use primers, backer rods, and sealant accessories recommended by sealant manufacturer.
- C. Colors: Provide colors of exposed sealants to match colors of grout in tile adjoining sealed joints unless otherwise indicated.
- D. 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 tile joints and other nonporous substrates that are subject to in-service exposures of high humidity and extreme temperatures.

PART 3 - EXECUTION

3.1 PROJECT CONDITIONS

- A. Environmental Limitations: Do not install tile until construction in spaces is completed and ambient temperature and humidity conditions are being maintained to comply with referenced standards and manufacturer's written instructions.

3.2 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 from oil, waxy films, and curing compounds; and within flatness tolerances required by referenced ANSI A108 series of tile installation standards for installations indicated.
 2. Verify that installation of grounds, anchors, recessed frames, electrical and mechanical units of work, and similar items located in or behind tile has been completed before installing tile.
 3. Verify that joints and cracks in tile substrates are coordinated with tile joint locations; if not coordinated, adjust latter in consultation with Architect.
- B. Do not proceed with installation until unsatisfactory conditions have been corrected.

3.3 PREPARATION

- A. Blending: For tile exhibiting color variations within the ranges selected during Sample submittals, verify that tile has been blended in the factory and packaged so tile units taken from one package show the same range in 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.

3.4 INSTALLATION, GENERAL

- A. ANSI Tile Installation Standards: Comply with parts of ANSI A108 series of tile installation standards in "Specifications for Installation of Ceramic Tile" that apply to types of setting and grouting materials and to methods indicated in ceramic tile installation schedules.
- B. TCA Installation Guidelines: TCA's "Handbook for Ceramic Tile Installation." Comply with TCA installation methods indicated in ceramic tile installation schedules.
- C. Extend tile work into recesses and under or behind equipment and fixtures to form a complete covering without interruptions, unless otherwise indicated. Terminate work neatly at obstructions, edges, and corners without disrupting pattern or joint alignments.
- D. Accurately form intersections and returns. Perform cutting and drilling of tile without marring visible surfaces. Carefully grind cut edges of tile abutting trim, finish, or built-in items for straight aligned joints. Fit tile closely to electrical outlets, piping, fixtures, and other penetrations so plates, collars, or covers overlap tile.
- E. Jointing Pattern: Lay tile in grid pattern, unless otherwise indicated. Lay out tile work and center tile fields in both directions in each space or on each wall area. Adjust to minimize tile cutting. Provide uniform joint widths, unless otherwise indicated.
1. For tile mounted in sheets, make joints between tile sheets the same width as joints within tile sheets so joints between sheets are not apparent in finished work.
- F. Lay out tile wainscots to next full tile beyond dimensions indicated.
- G. Expansion Joints: Locate expansion joints and other sealant-filled joints, including control, contraction, and isolation joints, where indicated during installation of setting

materials, mortar beds, and tile. Do not saw-cut joints after installing tiles.

1. Locate joints in tile surfaces directly above joints in concrete substrates.
2. Prepare joints and apply sealants to comply with requirements of Section 079200 - JOINT SEALANTS.

H. Grout tile to comply with the requirements of the following tile installation standards:

1. For ceramic tile grouts (sand-portland cement, dry-set, commercial portland cement, and latex-portland cement grouts), comply with ANSI A108.10.
2. For epoxy grout, comply with ANSI A118.3.

3.5 WALL TILE INSTALLATION

- A. Install types of tile designated for wall installations to comply with requirements in the Ceramic Tile Wall Installation Schedule, including those referencing TCA installation methods and ANSI setting-bed standards.
- B. Tile Wall Installation: Where wall installations of this designation are indicated, comply with the following:
 1. Interior wall installation over cementitious backer units; thin-set mortar; TCA W244 and ANSI A108.5.

3.6 CLEANING AND PROTECTION

- 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. Unglazed tile may be cleaned with acid solutions only when permitted by tile and grout manufacturer's written instructions, but no sooner than ten (10) days after installation. Protect metal surfaces, cast iron, and vitreous plumbing fixtures from effects of acid cleaning. Flush surface with clean water before and after cleaning.
- B. Finished Tile Work: Leave finished installation clean and free of cracked, chipped, broken, un-bonded, and otherwise defective tile work.
- C. Provide final protection and maintain conditions, in a manner acceptable to manufacturer and Installer that ensure tile is without damage or deterioration at the time of Substantial Completion.
- D. At end of each workday, remove rubbish other discarded materials from Project site.
- E. Protect the work of other trades and work of this Section already installed against soiling and damage by the exercise of reasonable care and precautions. Repair or replace any work so damaged or soiled.
- F. At completion of construction activities of other trades, touch up and restore damaged or defaced coated surfaces.

3.7 WASTE MANAGEMENT

- A. Separate and dispose of waste in accordance with the Project's Waste Management Plan.

END OF SECTION

SECTION 095110 - ACOUSTICAL CEILING ASSEMBLIES

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes the following:
 - 1. Acoustical panels and exposed suspension systems for ceilings.
 - 2. Direct-applied acoustical panel ceilings.
- B. Related Documents and Sections: Examine Contract Documents for requirements that directly affect or are affected by Work of this Section. A list of those Documents and Sections include, but is not limited to the following:
 - 1. Drawings and general provisions of the Contract, including General and Supplementary Conditions, and Division 01 General Requirements Specification Sections, apply to this Section.
 - 2. Section 092900 - GYPSUM BOARD.
 - 3. Division 23 - HVAC.
 - 4. Division 26 - ELECTRICAL.

1.2 DEFINITIONS

- A. CAC: Ceiling Attenuation Class.
- B. LR: Light Reflectance coefficient.
- C. NRC: Noise Reduction Coefficient.

1.3 SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Samples for Verification: For each component indicated and for each exposed finish required, prepared on Samples of size indicated below.
 - 1. Acoustical Panel: Set of 12-inch- square Samples of each type, color, pattern, and texture.
 - 2. Exposed Suspension System Members, Moldings, and Trim: Set of 12-inch- long Samples of each type, finish, and color.
- C. Product Test Reports: Based on evaluation of comprehensive tests performed by a qualified testing agency, for each acoustical panel ceiling.
- D. Affidavits of Compliance: For each type of acoustical panel, provide manufacturer's letter of certification addressed to the State of North Carolina Construction Codes and

Fire Safety showing compliance with requirements of NFPA 101 "Life Safety Code" Section 26-3.3 for Class A, B, or C as required by the Code.

- E. Maintenance Data: For finishes to include in maintenance manuals.

1.4 QUALITY ASSURANCE

- A. Source Limitations:

1. Acoustical Ceiling Panel: Obtain each type through one source from a single manufacturer.
2. Suspension System: Obtain each type through one source from a single manufacturer.

- B. Fire-Test-Response Characteristics: Provide acoustical panel ceilings that comply with surface-burning characteristics complying with ASTM E 1264 for Class A materials as determined by testing identical products per ASTM E 84.

- C. Seismic Standard: Provide acoustical panel ceilings designed and installed to withstand the effects of earthquake motions according to CISCA's "Recommendations for Direct-Hung Acoustical Tile and Lay-in Panel Ceilings--Seismic Zones 0-2."

- D. Mockups: Build mockups to verify selections made under sample submittals and to demonstrate aesthetic effects and set quality standards for materials and execution.

1. Size and Location: Minimum 100 square feet for each panel type, in locations acceptable to Architect.
2. Provide complete installations with materials in systems, including panels, suspension system, wall moldings, light fixtures and mechanical grilles and diffusers.
3. Approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

- E. Preinstallation Conference: Conduct conference at Project site.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Deliver acoustical panels, suspension system components, and accessories to Project site in original, unopened packages and store them in a fully enclosed, conditioned space where they will be protected against damage from moisture, humidity, temperature extremes, direct sunlight, surface contamination, and other causes.

- B. Before installing acoustical panels, permit them to reach room temperature and a stabilized moisture content.

- C. Handle acoustical panels carefully to avoid chipping edges or damaging units in any way.

- D. Indoor Air Quality Management Plan: Implement the following practices in accordance with the Construction Indoor Air Quality Management Plan:

1. Store acoustical ceiling panels in accordance with manufacturer's recommendations for allowable temperature and humidity range. Do not allow panels to become damp.
2. Store acoustical ceiling panels separately from materials that have high short-term emissions. Materials with high short-term emissions include, but are not limited to: adhesives, sealants and glazing compounds (specifically those with petrochemical vehicles or carriers); paint, wood preservatives, and finishes; control and/or expansion joint fillers; hard finishes requiring adhesive installation; gypsum board (with associated finish processes and products); and composite or engineered wood products with formaldehyde binders.

1.6 PROJECT CONDITIONS

- A. Environmental Limitations: Do not install acoustical panel ceilings until spaces are enclosed and weatherproof, wet work in spaces is complete and dry, work above ceilings is complete, and ambient temperature and humidity conditions are maintained at the levels indicated for Project when occupied for its intended use.
 1. Pressurized Plenums: Operate ventilation system for not less than 48 hours before beginning acoustical panel ceiling installation.

1.7 COORDINATION

- A. Coordinate layout and installation of acoustical panels and suspension system with other construction that penetrates ceilings or is supported by them, including light fixtures, HVAC equipment, fire-suppression system, and partition assemblies.

1.8 EXTRA MATERIALS

- A. Furnish extra materials described below that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
 1. Acoustical Ceiling Panels: Full-size panels equal to 2.0 percent of quantity installed.

PART 2 - PRODUCTS

2.1 ACOUSTICAL PANELS, GENERAL

- A. Acoustical Panel Standard: Provide manufacturer's standard panels of configuration indicated that comply with ASTM E 1264 classifications as designated by types, patterns, acoustical ratings, and light reflectances, unless otherwise indicated.
 1. Mounting Method for Measuring NRC: Type E-400; plenum mounting in which face of test specimen is 15-3/4 inches away from test surface per ASTM E 795.
- B. Acoustical Panel Colors and Patterns: Match appearance characteristics indicated for each product type.

- C. Manufacturers: Manufacturers listed are provided to establish a standard of quality and performance. Provide the products listed, or equal acceptable to the Architect by one of the following:
1. Acoustical Ceilings:
 - a. Armstrong World Industries, Inc.
 - b. CertainTeed Corporation.
 - c. MBI.
 - d. United States Gypsum Company.
 2. Metal Suspension Systems and Trims:
 - a. Armstrong World Industries, Inc.
 - b. CertainTeed Corporation.
 - c. Chicago Metallic Corporation.
 - d. United States Gypsum Company.

2.2 ACOUSTICAL PANEL SYSTEMS

- A. Standard for Acoustical Units: Manufacturer's standard units of configuration indicated that comply with ASTM E1414 and ASTM E1264.
- B. ACT-01:
1. Basis-of-Design: Armstrong Calla Square Lay-in Tegalur.
 - a. ASTM Classification: Type IV, Form 2, Pattern E.
 - b. NRC: 0.85.
 - c. CAC: 35.
 - d. AC: 170.1
 - e. Fire Rating: Class A.
 - f. Light Reflectance: 0.86.
 - g. Recycled Content: 85%.
 2. Suspension System: Armstrong / Suprafine, 9/16", color matching ceiling tiles.

2.3 METAL SUSPENSION SYSTEMS, GENERAL

- A. Components: All main beams and cross tees shall be commercial quality hot dipped galvanized steel as per ASTM A 653. Main beams and cross tees are double-web steel construction with 9/16" type exposed flange design. Exposed surfaces chemically cleansed, capping prefinished galvanized steel in baked polyester paint. Main beams and cross tees shall have rotary stitching.
1. Structural Classification: ASTM C 635 HD.
 - a. Provide manufacturer's standard grid systems of types, structural classifications, and finishes indicated that comply with applicable requirements in ASTM C 635.
 - b. Grid: To suit each acoustic ceiling type indicated.
 - c. Color: Match the actual color of the selected ceiling tile, unless noted otherwise.

- B. Attachment Devices: Size for five times design load indicated in ASTM C 635, Table 1, Direct Hung, unless otherwise indicated.
- C. Main carrying channels, to which suspension systems shall be fastened, shall be 1-1/2" cold rolled galvanized steel channel; spaced 4'-0" o.c..
- D. Seismic Stabilizer Bars: Manufacturer's standard perimeter stabilizers designed to accommodate seismic forces.
- E. Seismic Struts: Manufacturer's standard compression struts designed to accommodate seismic forces.
- F. Edge Moldings and Trim: Metal or extruded aluminum of types and profiles indicated or, if not indicated, manufacturer's standard moldings for edges and penetrations, including light fixtures, that fit type of edge detail and suspension system indicated. Provide moldings with exposed flange of the same width as exposed runner.

2.4 METAL EDGE MOLDINGS AND TRIM

- A. Roll-Formed, Sheet-Metal Edge Moldings and Trim: Type and profile indicated or, if not indicated, manufacturer's standard moldings for edges and penetrations that comply with seismic design requirements; formed from sheet metal of same material, finish, and color as that used for exposed flanges of suspension system runners.
 - 1. Products: Subject to compliance with requirements, provide products by same manufacturer as corresponding metal suspension system.
 - 2. Provide manufacturer's standard edge moldings that fit acoustical panel edge details and suspension systems indicated and that match width and configuration of exposed runners, unless otherwise indicated.
 - 3. Where indicated, provide stepped edge molding that forms reveal of same depth and width as that formed between edge of panel and flange at exposed suspension member.
 - 4. For circular penetrations of ceiling, provide edge moldings fabricated to diameter required to fit penetration exactly.
- B. Extruded-Aluminum Edge Trim: Where indicated, provide manufacturer's extruded-aluminum edge moldings and trim of profile indicated or referenced by manufacturer's designations, including splice plates, factory-fabricated inside corners and outside corners, and attachment and other clips, complying with seismic design requirements and the following:
 - 1. Basis-of-Design Product:
 - a. Design for extruded-aluminum edge trim is based on Axiom Perimeter Trim by Armstrong World Industries, Inc.
 - b. Subject to compliance with requirements, provide the Basis-of-Design Product or a comparable product by another manufacturer acceptable to Architect.
 - 2. Aluminum Alloy: Alloy and temper recommended by aluminum producer and finisher for type of use and finish indicated, and with not less than the strength and durability properties of aluminum extrusions complying with ASTM B 221 for Alloy and Temper 6063-T5.

3. Finish designations prefixed by AA comply with system established by the Aluminum Association for designating aluminum finishes.
4. Baked-Enamel Finish: AA-C12C42R1x (Chemical Finish: cleaned with inhibited chemicals; Chemical Finish: acid-chromate-fluoride-phosphate conversion coating; organic coating: as specified below). Apply baked enamel complying with paint manufacturer's written instructions for cleaning, conversion coating, and painting.
 - a. Organic Coating: Thermosetting, primer/topcoat system with a minimum dry film thickness of 0.8 to 1.2 mils.
 - b. Color: White, to match color of exposed flanges of suspension system runners.
5. Profile and nominal height: As indicated on Drawings.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates, areas, and conditions, including structural framing to which acoustical panel ceilings attach or abut, with Installer present, for compliance with requirements specified in this and other Sections that affect ceiling installation and anchorage and with requirements for installation tolerances and other conditions affecting performance of acoustical panel ceilings.
 1. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Measure each ceiling area and establish layout of acoustical panels to balance border widths at opposite edges of each ceiling. Avoid using less-than-half-width panels at borders, and comply with layout shown on reflected ceiling plans.

3.3 INSTALLATION

- A. General: Install acoustical panel ceilings to comply with ASTM C 636 and seismic design requirements indicated, per manufacturer's written instructions and Cisca's "Ceiling Systems Handbook."
- B. Suspend ceiling hangers from building's structural members and as follows:
 1. Install hangers plumb and free from contact with insulation or other objects within ceiling plenum that are not part of supporting structure or of ceiling suspension system.
 2. Splay hangers only where required to miss obstructions; offset resulting horizontal forces by bracing, countersplaying, or other equally effective means.
 3. Where width of ducts and other construction within ceiling plenum produces hanger spacings that interfere with location of hangers at spacings required to support standard suspension system members, install supplemental suspension members and hangers in form of trapezes or equivalent devices.
 4. Secure hangers to ceiling suspension members and to supports above with a

- minimum of three tight turns. Connect hangers directly either to structures or to inserts, eye screws, or other devices that are secure and appropriate for substrate and that will not deteriorate or otherwise fail due to age, corrosion, or elevated temperatures.
5. Do not support ceilings directly from permanent metal forms or floor deck. Fasten hangers to cast-in-place hanger inserts, postinstalled mechanical anchors, or power-actuated fasteners that extend through forms into concrete.
 6. When steel framing does not permit installation of hangers at spacing required, install carrying channels or other supplemental support for attachment of hangers.
 7. Do not attach hangers to steel deck tabs or roof deck. Attach hangers to structural members.
 8. Space hangers not more than 48 inches o.c. along each member supported directly from hangers, unless otherwise indicated; provide hangers not more than 8 inches from ends of each member.
 9. Size supplemental suspension members and hangers to support ceiling loads within performance limits established by referenced standards and publications.
- C. Install edge moldings and trim of type indicated at perimeter of acoustical ceiling area and where necessary to conceal edges of acoustical panels.
1. Screw attach moldings to substrate at intervals not more than 16 inches o.c. and not more than 3 inches from ends, leveling with ceiling suspension system to a tolerance of 1/8 inch in 12 feet. Miter corners accurately and connect securely.
 2. Do not use exposed fasteners, including pop rivets, on moldings and trim.
- D. Install suspension system runners so they are square and securely interlocked with one another. Remove and replace dented, bent, or kinked members.
- E. Install acoustical panels with undamaged edges and fit accurately into suspension system runners and edge moldings. Scribe and cut panels at borders and penetrations to provide a neat, precise fit.
1. For square-edged panels, install panels with edges fully hidden from view by flanges of suspension system runners and moldings.
 2. For reveal-edged panels on suspension system members with box-shaped flanges, install panels with reveal surfaces in firm contact with suspension system surfaces and panel faces flush with bottom face of runners.
 3. Paint cut edges of panel remaining exposed after installation; match color of exposed panel surfaces using coating recommended in writing for this purpose by acoustical panel manufacturer.
 4. Install hold-down clips in areas indicated, in areas required by authorities having jurisdiction, and for fire-resistance ratings; space as recommended by panel manufacturer's written instructions, unless otherwise indicated.

3.4 CLEANING

- A. Clean exposed surfaces of acoustical panel ceilings, including trim, edge moldings, and suspension system members. Comply with manufacturer's written instructions for

cleaning and touchup of minor finish damage. Remove and replace ceiling components that cannot be successfully cleaned and repaired to permanently eliminate evidence of damage.

END OF SECTION

SECTION 096513 - RESILIENT BASE AND ACCESSORIES

PART 1 - GENERAL

1.1 SUMMARY

- A. Work of this Section consists of resilient tile flooring, and includes but is not limited to the following:
 - 1. Substrate preparation and testing.
 - 2. Resilient base.
 - 3. Installation adhesives and accessories.
- B. Related Documents and Sections: Examine Contract Documents for requirements that directly affect or are affected by Work of this Section. Other Documents and Sections that directly relate to work of this Section include, but are not limited to:
 - 1. General provisions of the Contract, including General and Supplementary Conditions, and Division 01 General Requirements Specification Sections.
 - 2. Section 096770 - SEALED CONCRETE FINISH.
 - 3. Section 096723 - RESINOUS FLOORING.

1.2 SUBMITTALS

- A. Action Submittals:
 - 1. Shop Drawings: For each type of floor covering. Include floor covering layouts, locations of seams, edges, columns, doorways, enclosing partitions, built-in furniture, cabinets, and cutouts.
 - a. Show details of special patterns.
 - 2. Samples: For each type of floor covering indicated.
 - a. Samples for Verification: In manufacturer's standard size, but not less than 6 by 9 inch sections of each different color and pattern of floor covering required.
- B. Informational Submittals:
 - 1. Quality Assurance Submittals
 - a. Resilient Flooring: Manufacturer's written information regarding resilient flooring performance data provided by an independent testing lab.
 - b. Adhesives: Manufacturer's written information regarding compatibility of adhesive with substrate and resilient flooring material.
- C. Closeout Submittals:
 - 1. Manufacturer's instructions and product limitations for materials used in the Work of this Section.

1.3 QUALITY ASSURANCE

- A. Manufacturer Qualifications: A firm experienced in manufacturing products or systems similar to those indicated for this Project and with a record of successful in-service performance.
- B. Installer Qualifications: A qualified installer who employs workers for this Project who are competent in techniques required by manufacturer for floor covering installation indicated.
 - 1. Engage an installer who employs workers for this Project who are trained or certified by floor covering manufacturer for installation techniques required.
- C. Fire-Test-Response Characteristics: As determined by testing identical products according to ASTM E648 or NFPA 253 by a qualified testing agency

PART 2 - PRODUCTS

2.1 RESILIENT WALL BASE

- A. Manufacturers: Provide wall base as manufactured by Roppe, Johnsonite, or acceptable equivalent.
- B. Wall Base: Furnish at walls indicated.
 - 1. Type: TS (Thermoset Vulcanized Rubber)
 - 2. Group: 1 (Solid)
 - 3. Furnish coved and straight styles as required for each floor condition.
 - 4. Preformed Corners: Manufacturer's standard.
 - 5. Thickness: 1/8 in.
 - 6. Height: 4 inches.
 - 7. Color: Refer to Drawings.

2.2 ACCESSORIES

- A. Patching Cements: Non-gypsum, Portland cement compound, Min. 3500 psi compressive strength.

2.3 PRIMERS AND ADHESIVES

- A. Water-resistant, mildew-resistant, non-staining, pressure-sensitive type to suit products and subfloor conditions indicated, that complies with flammability requirements for resilient flooring and is recommended by resilient flooring manufacturer for releasable installation.
- B. Provide adhesives that comply with the following limits for VOC content when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

- C. Compatibility: Provide adhesives specifically recommended by flooring manufacturer for compatibility between flooring material and substrate. Manufacturers:
- D. Manufacturers:
 - 1. Acrylic Adhesive: Ecofix 25 for adhering flooring to substrate.
 - 2. Polyurethane Adhesive: Altrofix 31 for adhering flooring to substrate
 - 3. All Purpose Adhesives Company- APAC
 - 4. Static Control Tile Adhesive: VPI No. 150 or VPI No. 160
 - 5. Architect acceptable equivalent

PART 3 - EXECUTION

3.1 PROJECT CONDITIONS

- A. Install resilient sheet flooring after other finishing operations, including painting, have been completed.
- B. Maintain 68 degrees F temperature continuously prior to, during and after installation, but for not less than 48 hours prior and after. Maintain a temperature of not less than 55 degrees F in areas where work is completed.

3.2 EXAMINATION

- A. Examine substrates, with Installer present, for compliance with requirements for maximum moisture content and other conditions affecting performance of the Work.
- B. 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 floor tile.

3.3 PREPARATION

- A. Acclimatize flooring materials for Seventy two (72) hours in advance of installation.
- B. Sweep and vacuum clean substrates to be covered by resilient products immediately before installation.

3.4 RESILIENT BASE INSTALLATION

- A. General: Do not cove material over non-porous surfaces (vinyl wallcoverings, marlite, HPL, epoxy paint, etc) without first making sure a proper bond can be achieved.
- B. Resilient Cove Base Installation
 - 1. Factory-Formed Resilient Base: Install in accordance with manufacturer's recommendations.
 - a. Provide unit lengths that minimize seams.

2. Preformed Corners: Provide manufacturer's preformed inside and outside corners as needed.
3. Sanitary Base: Provide sealant recommended by manufacturer, compatible with both flooring and cove material to produce a continuous, water-tight seal.

3.5 CLEANING AND PROTECTION

- A. Comply with manufacturer's written instructions for cleaning and protection of resilient flooring.
- B. Immediately after completing floor installation:
 1. Remove adhesive and other blemishes from exposed surfaces.
 2. Sweep and vacuum surfaces thoroughly.
 3. Damp-mop surfaces to remove marks and soil.
- C. Protection:
 1. Protect newly installed flooring from foot traffic for 24 hours and rolling traffic, furniture and fixtures for 48 hours.
 2. Protect floor from other trades as well as potential discoloration from certain chemicals such as oils, asphalt or bitumen.
 3. If heavy rolling equipment is to be moved over a new floor in the first week, it is advisable to lay masonite on the flooring to protect the adhesive bond.
 4. Floor protection (coasters) should be used under legs of heavy furniture. Cleaning can take place after the adhesive has cured (approximately 5-7 days following installation).
- D. Joint Sealant: Apply sealant to resilient floor perimeter and around columns, at doorframes, and at other joints and penetrations.
- E. Cover floor tile until Substantial Completion.
- F. At end of each workday, remove rubbish other discarded materials from Project site.
- G. Protect the work of other trades and work of this Section already installed against soiling and damage by the exercise of reasonable care and precautions. Repair or replace any work so damaged or soiled.

3.6 WASTE MANAGEMENT

- A. Separate and dispose of waste in accordance with the Project's Waste Management Plan.

END OF SECTION

SECTION 096523 - LUXURY VINYL TILE

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Luxury vinyl tile flooring as indicated.
- B. Related Documents and Sections: Examine Contract Documents for requirements that directly affect or are affected by Work of this Section. A list of those Documents and Sections includes, but is not limited to the following:
 - 1. Drawings and general provisions of the Contract, including General and Supplementary Conditions and General Requirements, and Division 01 Specification Sections.
 - 2. Section 033000 - CAST-IN-PLACE CONCRETE.
 - 3. Section 096513 - RESILIENT BASE AND ACCESSORIES.

1.2 DEFINITIONS

- A. Pop-up: A pop-up is defined as any surface deviation or looseness of substrate that is equal to or greater than 1/64 (0.015625) inch above the concrete floor level, regardless of the size.

1.3 SUBMITTALS

- A. Product Data: Submit manufacturer's published technical data describing materials, construction and recommended installation instructions. Submit technical data and installation instructions for each adhesive material. Submit list and Product Data of recommended finish materials.
- B. Maintenance Instructions: Submit manufacturer's recommendations for maintenance, care, and cleaning of luxury vinyl tile.
- C. Samples: Submit Samples of luxury vinyl tile and any reducers or transitions in each available color and pattern. Following color selections, submit full size samples of each selected color and pattern. Submit 16 oz. cans of each type of adhesive.
- D. Maintenance Materials: Before Substantial Completion, deliver one unopened container of each color and pattern of luxury vinyl tile in each color and pattern installed. Label each container indicating locations installed. Include unopened cans of adhesives adequate to install the maintenance materials.
- E. Installer's Experience Qualifications: Submit list of not less than five projects, extending over period of not less than five years, indicating installer's experience record. Submit letter from manufacturer indicating manufacturer's approval for installer of the products.

1.4 QUALITY ASSURANCE

- A. Qualifications of Installer: Minimum five years' experience in successfully installing the same or similar flooring materials.
- B. Pre-Installation Meeting: Prior to start of work of this section and after approval of submittals, schedule on-site meeting between Contractor and Architect to review installation and procedures required for project.
- C. Comply with the following as a minimum requirement:
 - 1. Materials shall be compliant with requirements of ADAAG.
 - 2. ASTM E84: Class A Flame Spread Rating of 25 or less.
 - 3. Moisture Testing: ASTM F1869 and ASTM F2170.

1.5 DELIVERY, STORAGE AND HANDLING

- A. Materials shall be delivered to the Project site in original unopened manufacturer's packaging clearly labeled with manufacturer's name.
- B. Materials shall be stored at room temperature, but not less than 70 degrees F for not less than 48 hours before installation, unless manufacturer's instructions specify otherwise.

1.6 PROJECT CONDITIONS

- A. Ventilation and Temperature: Verify areas that are to receive new flooring are ventilated to remove fumes from installation materials. Verify that areas are within temperature range recommended by the various material manufactures for Project site installation conditions.

1.7 WARRANTY

- A. Manufacturer shall provide a twenty year wear material warranty.
- B. Installer shall provide a five year fabrication and installation warranty.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Provide basis-of-design products as manufactured by Mohawk, or acceptable equivalent by one of the following:
 - 1. InterfaceFLOR
 - 2. Shaw industries, Inc.
 - 3. Tandus Centiva
 - 4. Armstrong

- B. Basis-of-Design: Mohawk Group Bolder C0010 in 925 Pebble

2.2 MATERIALS

- A. Luxury Vinyl Tile: Conform to ASTM F1700, Class III (printed film vinyl), type A, minimum 2.5 mm thick. Minimum of 20 mil wear layer.
- B. Crack Filler and Leveling Compound: 100 percent cementitious binder type as defined by ASTM C150. Leveling Compound shall meet or exceed 200 pounds when tested in accordance with ASTM C 1583:
 - 1. Webcrete #95 as manufactured by Durabond.
 - 2. Ardex SD-F.
 - 3. Armstrong S184.
 - 4. Equal, as recommended by flooring manufacturer and accepted by the Architect.
- C. Interlocking floating glue free installation.
- D. Concrete Primer: Non-staining type recommended by manufacturer of luxury vinyl tile.
- E. Adhesive: Water based, low odor type formulated specially for installation with luxury vinyl tile, recommended by manufacturer.
- F. Reducer Strips: Tapered rubber not less than one inch wide, and thickness to match tile.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Field verify and correct deficiencies of conditions affecting Work before commencing Work of this section.

3.2 COORDINATION

- A. Coordinate with related Work to assure level, dry, smooth, and clean finish surfaces to receive luxury vinyl floor tile.

3.3 PREPARATION OF CONCRETE SLABS

- A. Do not start preparation until underlying concrete floor slabs are at least 90 days old. Any leveling compound under a vapor or moisture barrier shall be warranted to be installed in a wet or moist environment without moisture limitations.
- B. Leveling: Check sub-floors for true to level and plane within the tolerance listed in Manufacturer's installation instructions. Test floor areas both ways with a 10-foot straightedge and repair high and low areas exceeding allowable tolerance. Pop ups shall be hammered out and floor filled with an approved cementitious leveling compound. Remove high areas by power sanding, stone rubbing or grinding, chipping off and filling with an approved leveling compound, or equivalent method. Fill low areas with an

approved leveling compound. Repair and level surfaces having abrupt changes in plane, such as trowel marks or ridges, whether or not within allowable tolerance. Clean areas where repairs are performed.

- C. Cracks or Depressions: Fill voids with an approved cementitious leveling compound of the type recommended by flooring manufacturer for the specific Work conditions.
- D. Cleaning: After leveling, clean substrates of deleterious substances and foreign substances.

3.4 INSTALLATION OF TILE

- A. Color and pattern: Install tiles in the pattern indicated on Drawings. If no pattern is indicated, tiles shall be installed in a rectangular pattern, in one color.
- B. Install luxury vinyl floor tile when ambient temperature is 70 degrees F or higher or manufacturer's range.
- C. Install the tile adhesive in a thin film evenly with a notched trowel. Trowel notches shall be as recommended by adhesive manufacturer.
 - 1. Mix adhesive in accordance with manufacturer's instructions.
 - 2. Install adhesive only in area that can be covered by flooring material within the adhesive manufacture's recommended working time. Adhesive application rate shall be as required to avoid telegraphing trowel lines to the surface after maintenance coatings are applied. Adjust tile runoff during installation if necessary.
 - 3. Immediately remove any excess adhesive from the tile surface using the adhesive manufacturer's recommended cleaner and a damp, not wet, cloth.
- D. Provide reducer where floor covering edges are exposed, such as at center of the door or where floor coverings terminate.
- E. Install tiles symmetrically about centerlines of areas progressing toward walls. Adjust border tiles to be even on all walls or nothing smaller than a 3" piece. Tiles shall be straight and joints close. Tile shall be cut to fit snug door jambs casing, pipes fixtures and walls. No slivers at edges.
- F. Mechanically cut flooring material to produce square true edges.
- G. As floor tile is installed and within adhesive's recommended working time, roll with a clean, smooth, 100-pound roller in both directions. As the rolling proceeds, replace any loosened, defective, or damaged tile with new and finish to the specified condition.
- H. Remove dust, debris, and soil with any combination of sweeping, micro-fiber dust-mopping with a properly treated, non-oily mop and vacuuming.

3.5 CLEANING AND COMPLETION

- A. Maintain flooring surfaces clean as installation progresses.
- B. Use a sprayer to mist the area to be cleaned with a neutral cleaning solution prepared in

accordance with manufacturer's instructions.

- C. Gently scrub the floor using red or maroon cleaning, not stripping pads, mounted on a single disc, 175 RPM floor machine; or preferably, with a machine that uses horizontally mounted brushes with a counter-rotating spindle motion. Never allow the machine to remain running stationary.
- D. Remove the resulting slurry with a wet vacuum.
- E. Rinse the floor at least four times, each time using a clean mop and clean rinse water. On the first rinse, apply just enough water to keep the floor wet until the solution is picked-up with a vacuum. The next two rinses should be with a fairly well wrung-out, damp mop. The final rinse should produce virtually clean rinse water. Ensure the rinse water is clean throughout the rinsing process. Avoid tracking the floor after the final rinse. Check the floor after the final rinse for any missed areas and re-scrub/rinse as needed. Repeat the rinsing process until all signs of the cleaning solution are removed and the floor shows no sign of haziness or dusting when dry. If the Contractor has lightweight "automatic" floor machines capable of achieving the same result as described above, they may be used in-place of this method. Do not flood or excessively dampen floor at any time.
- F. Allow the Work to dry thoroughly.
- G. Clean adjacent baseboard and other surfaces of adhesive and other materials. Replace damaged or defective Work to the specified condition.

3.6 CLEAN UP

- A. Remove rubbish, debris, and waste materials and legally dispose of off Project site.

3.7 PROTECTION

- A. Protect the Work of this section until Substantial Completion.

3.8 WASTE MANAGEMENT

- A. Separate and dispose of waste in accordance with the Project's Waste Management Plan.

END OF SECTION

SECTION 096723 - RESINOUS FLOORING

PART 1 - GENERAL

1.1 SUMMARY

- A. Work of this Section includes all labor, materials, equipment and services necessary to complete the resinous flooring system with integral cove base as scheduled on the Drawings and specified herein. Locations include, but are not limited to:
 - 1. Bathrooms.
- B. Related Documents and Sections: Examine Contract Documents for requirements that directly affect or are affected by Work of this Section. Other Documents and Sections that directly relate to work of this Section include, but are not limited to:
 - 1. General provisions of the Contract, including General and Supplementary Conditions, and Division 01 General Requirements Specification Sections.
 - 2. Section 079200 - JOINT SEALANTS.

1.2 SUBMITTALS

- A. Product Data: Submit manufacturer's technical data, application instructions and general recommendations for the resinous flooring specified herein.
- B. Samples for initial selection purposes in form of manufacturer's color charts showing full range of colors and finishes available.
 - 1. Submit 2 1/2" x 4" samples of color chips from color chart selection designated by the Architect.
- C. Material certificates signed by manufacturer certifying that the resinous flooring complies with requirements specified herein.
- D. Maintenance Instructions: Submit manufacturer's written instructions for recommended maintenance practices.

1.3 QUALITY ASSURANCE

- A. Installer Qualifications: Engage an experienced Installer or applicator who has specialized in installing resinous coating types similar to that required for this Project and who is acceptable to manufacturer of primary materials.
- B. Single Source Responsibility: Obtain resinous flooring materials, including primers, resins, hardening agents, and finish or sealing coats, from a single manufacturer.
- C. Qualified Materials: Request for material approvals for any products other than the specified products must be submitted to the Architect two weeks prior to the bid,

including complete application specification, physical characteristics, and chemical resistance data. Any request after this date will not be accepted. Failure of performance requires immediate removal and replacement of unapproved substituted material with those originally specified at no cost to the owner, Architect, construction manager, or general contractor.

1.4 DELIVERY, STORAGE AND HANDLING

- A. Deliver materials in original packages and containers with seals unbroken and bearing manufacturer's labels containing brand name and directions for storage and mixing with other components.
- B. Store materials to comply with manufacturer's directions to prevent deterioration from moisture, heat, cold, direct sunlight, or other detrimental effects.

1.5 PROJECT CONDITIONS

- A. Environmental Conditions: Comply with resinous flooring manufacturer's directions for maintenance of ambient and substrate temperature, moisture, humidity, ventilation, and other conditions required to execute and protect Work.
- B. Lighting: Permanent lighting will be in place and working before installing resinous coating.

PART 2 - PRODUCTS

2.1 RESINOUS FLOORING (EF-01)

- A. Epoxy Mortar System: Trowel-applied resin-based monolithic surfacing with integral cove base designed to produce a seamless coating.
 - 1. Basis-of-Design Product: Subject to compliance with requirements, provide Cheminert K as manufactured by Dex-O-Tex; or accepted comparable product by one of the following:
 - a. BASF Construction Chemicals - Building Systems.
 - b. Crossfield Products Corp.
 - c. General Polymers; Sherwin Williams.
 - d. Sika Corporation.
- B. System Characteristics:
 - 1. Color: As selected by the Architect.
 - 2. Wearing Surface: Smooth.
- C. Physical Properties: Provide flooring system that meet or exceed the listed minimum physical property requirements when tested according to the referenced standard test method in parentheses.
 - 1. Compressive Strength (ASTM C579): 11,000 psi.

2. Tensile Strength (ASTM C307): 1,643 psi.
3. Flexural Modulus of Elasticity (ASTM C580): 4,300 psi.
4. Water Absorption (MIL PRF 3134): 0.3 percent max.
5. Surface Hardness (ASTM D2240): 85.5 Durometer "D"
6. Abrasion Resistance (ASTM D1044): 0.04 gr.
7. Impact Resistance (MIL PRF 3134, Para 4.7.3): 0.024" max.; no chipping, cracking loss of adhesion
8. Impact Resistance (Gardner Impact Tester): No chipping, cracking, or delamination and not more than 0.014" indentation
9. Adhesion (A.C.I. Comm. No. 503.1): 400 psi (100% failure in concrete)
10. Electrical Conductivity (NFPA 56A): Di-electric
11. Flammability Critical Radiant Flux (ASTM E648): Greater than 1.07 watts/cm²

2.2 SUPPLEMENTAL MATERIALS

- A. Waterproofing Membrane: Type recommended or produced by manufacturer of epoxy resin composition flooring system for type of service and floor condition indicated.
- B. Textured Top Coat: Type recommended or produced by manufacturer of epoxy resin matrix flooring system for type and profile of desired final finish.
- C. Anti-Microbial Additive: Incorporate antimicrobial chemical additive to prevent growth of most bacteria, fungi, algae and actinomycetes

PART 3 - EXECUTION

3.1 INSPECTION

- A. Examine the areas and conditions where the epoxy resin composition flooring is to be installed and notify the Architect of conditions detrimental to the proper and timely completion of the work. Do not proceed with the work until unsatisfactory conditions have been corrected by the Contractor in a manner acceptable to the Architect.
- B. Test for moisture vapor transmission. Notify Architect immediately if moisture vapor transmission exceeds manufacturers recommended levels.

3.2 PREPARATION

- A. Substrate: Perform preparation and cleaning procedures according to flooring manufacturer's instructions for particular substrate conditions involved, and as specified. Provide clean, dry, and neutral substrate for flooring application.
- B. Concrete Surfaces: Shot blast, acid etch or power scarify as required to obtain optimum bond of flooring to concrete. Remove sufficient material to provide a sound surface free of laitance, glaze, efflorescence, and any bond inhibiting curing compounds or form release agents. Remove grease, oil, and other penetrating contaminants. Repair damaged and deteriorated concrete to acceptable condition. Leave surface free of dust,

dirt, laitance, and efflorescence.

- C. Materials: Mix resin hardener and aggregate when required, and prepare materials according to flooring system manufacturer's instructions.

3.3 APPLICATION

- A. General: Apply each component of epoxy resin composition flooring system according to manufacturer's directions to produce a uniform monolithic flooring surface of thickness indicated.
- B. Bond Coat: Apply bond coat over prepared substrate at manufacturer's recommended spreading rate.
- C. Body Coat: Over primer, trowel apply epoxy mortar mix at nominal 1/4 inch thickness; hand or power trowel. When cured, sand or grind if necessary to remove trowel marks and roughness.
- D. Finish or Sealing Coats: After body coat has cured sufficiently, apply grout and finish coats of type recommended by flooring manufacturer to produce finish matching approved sample and in number of coats and spreading rates recommended by manufacturer.
 - 1. Final finish coat shall be in color and skid retardant profile as approved by the Architect.
 - 2. Finished floor shall be 1/4" thick, uniform in color and free of trowel marks.
- E. Cove Base: Apply cove base mix to wall surfaces at locations shown to form cove base height of 4 inches unless otherwise indicated. Follow manufacturer's instructions and details including taping, mixing, priming, troweling, sanding, and top coating of cove base.

3.4 CURING, PROTECTION AND CLEANING

- A. Cure epoxy resin composition flooring materials according to manufacturer's directions, taking care to prevent contamination during application stages and before completing curing process. Close application area for a minimum of 24 hours.
- B. Protect finished floor with wax paper. Use Masonite, if rolling load traffic exists.
- C. Clean with manufacturer recommended cleaner.

3.5 WASTE MANAGEMENT

- A. Separate and dispose of waste in accordance with the Project's Waste Management Plan.

END OF SECTION

SECTION 096770 - SEALED CONCRETE FINISH

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Single application sealer-hardener for concrete floors indicated.
2. Precautions for avoiding staining concrete before and after application.

B. Related Documents and Sections: Examine Contract Documents for requirements that directly affect or are affected by Work of this Section. Other Documents and Sections that directly relate to work of this Section include, but are not limited to:

1. Drawings and general provisions of the Contract, including General and Supplementary Conditions, and Division 01 General Requirements Specification Sections.
2. Section 033000 - CAST-IN-PLACE CONCRETE.
3. Section 079200 - JOINT SEALANTS.

1.2 SUBMITTALS

A. Action Submittals:

1. Material Requirements for Concrete: Substrate to which cure-seal hardener is to be applied, including cement type, water-cement ratio, type of trowel finish, limitations on admixtures, pigments, bonding agents, and bond breakers.
2. Product Data: Submit manufacturer's printed descriptions of materials and systems, performance criteria, use limitations, recommendations and installation information for each manufactured product specified or called out by the Drawings and this Section.

B. Informational Submittals:

1. Certificates: Manufacturer's certification that the installer is acceptable.

C. Closeout Submittals:

1. Maintenance Data: Maintenance instructions, including precautions for avoiding staining after application.

1.3 QUALITY ASSURANCE

- A. Installer Qualifications:** Applicator experienced with installation of product and certified by manufacturer, or applicator experienced with similar products and providing manufacturer's field technician of site to advise on application procedures; and

providing adequate number of skilled workers trained and familiar with application requirements.

1. Manufacturer capable of providing field service representation during installation, approving acceptable installer and approving application method.

B. Pre-installation Meetings:

1. Purpose: To review installation requirements.
2. Attendees: Architect, Contractor, Installer.

1.4 DELIVERY, STORAGE & HANDLING

- A. Delivery: Deliver materials in manufacturer's original, unopened, undamaged containers with identification labels intact.
- B. Storage and Protection: Store materials protected from exposure to harmful environmental conditions and at temperature and humidity conditions recommended by the manufacturer.
- C. Handling: Protect materials from dirt, corrosion, oil, grease and other contaminants.

1.5 PROJECT CONDITIONS

- A. Take precautions to prevent staining of concrete prior to application of sealer and for a minimum of three months after application:
 1. Prohibit parking of vehicles on concrete slab.
 2. Protect slab with drop cloths if vehicle traffic is unavoidable.
 3. If construction equipment must be used for application, diaper components that might drip oil, hydraulic fluid, or other liquids.
 4. Prohibit pipe cutting using pipe cutting machinery on the concrete slab.
 5. Prohibit temporary placement and storage of steel members on concrete slab.
- B. Install products only under environmental conditions within manufacturer's recommended limits.

1.6 WARRANTY

- A. Contractor shall warrant installation for a period of two (2) years.
- B. Warranty: Furnish two (2) year written warranty signed by the manufacturer and installer agreeing to repair or replace work which has failed as a result of defects in materials or workmanship. Upon notification within the warranty period, such defects shall be repaired at no cost to the Owner.
- C. Provide manufacturer's warranty that a structurally sound concrete surface prepared and treated according to the manufacturer's directions will remain permanently dustproof, hardened and water repellent. If after the specified sealing period the treated surface does not remain dustproof, hardened and water repellent, provide, at

manufacturer's expense, sufficient material to reseal defective areas.

PART 2 - MATERIALS

2.1 MATERIAL

A. Penetrating Concrete Hardener/Densifier:

1. Description: Lithium silicate hardener/densifier.
2. Basis-of-Design Product: Consolideck LS/CS, manufactured by PROSOCO, Inc., Lawrence, KS. provide this product, or equivalent by one of the following:
 - a. Nox-Crete Products Group
 - b. L&M Chemicals.
 - c. Architect acceptable equivalent.

B. Subject to compliance with the following minimum performance requirements:

1. Living Building Challenge 2.0/2.1 Red List Compliant.
2. Recipient of Scientific Certification System (SCS) Indoor Air Quality Gold Certification.
3. Comply with national, state and district AIM VOC regulations and contain 50 g/L or less.
4. Registered as an approved NSF International/Nonfood Compound Registration.
5. Abrasion Resistance: Greater than 50 percent improvement over untreated samples when tested in accordance with ASTM C1353.
6. Achieve 'High Traction Range' readings when tested in accordance with ANSI B101.1.
7. Coefficient of Friction: Greater than 0.60 dry, Greater than 0.60 wet when tested in accordance with ASTM C1028.
8. Adhesion: Greater than 10 percent increase in pull-off strength when compared to an untreated sample when tested in accordance with ASTM D4541.
9. Water Vapor Transmission: 100 percent retained when compared to untreated samples when tested in accordance with ASTM E96/96M Method B (Water Method).
10. UV Stability: No degradation or yellowing of material when tested in accordance with ASTM G154.

2.2 EQUIPMENT

- #### A. Auto Scrubber Machine: For cleaning operations.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrate with installer present for conditions affecting performance of finish. Correct conditions detrimental to timely and proper work. Notify the [Architect][Owner's Representative] in writing of conditions detrimental to the proper and timely completion of the work.
- B. Do not begin installation until unsatisfactory conditions are resolved. Beginning work constitutes acceptance of site conditions and responsibility for defective installation caused by prior observable conditions.

3.2 PREPARATION

- A. Clean dirt, dust, oil, grease and other contaminants that interfere with penetration or performance of specified product from surfaces.
- B. Remove remnants of curing compound, bond breaker, and construction laitance prior to application of densifier. Remove by cleaning and scrubbing in accordance with manufacturer's instructions.
- C. Repair, patch and fill cracks, voids, defects and damaged areas in surface as approved by the [Architect][Owner's Representative]. Allow repair materials to cure completely before application of product.
- D. Scrub floor with pre-densifier floor cleaner to remove latent salts.
- E. Do not proceed until unsatisfactory conditions have been corrected.

3.3 APPLICATION

- A. Freshly Placed, Uncured Steel Troweled Concrete: Concrete: Apply concrete hardener/densifier after final concrete finishing and final soft cut control joints. Apply according to manufacturer's written instructions and as follows:
 - 1. Clean concrete to remove dirt/residue of soft cut saw debris.
 - 2. Apply hardener/densifier per manufacturer's recommended application rate to designated finished floor area, with a low pressure sprayer fitted with a 0.5 gpm spray tip.
 - 3. Apply sufficient material to wet the surface without producing puddles. Use a clean soft-bristle push broom or microfiber pad to spread the hardener/densifier evenly to achieve uniform wetting. Avoid spreading once drying begins. Surface should remain wet for 5 to 10 minutes. Avoid over-application. (Scrubbing is not necessary.)
 - 4. Allow treated surfaces to dry.
 - 5. Immediately apply the specified curing compound or initiate the specified curing procedure.

- B. Cured Steel Troweled Concrete: Apply concrete hardener/densifier to cured steel troweled concrete. Apply according to manufacturer's written instructions and as follows:
1. Remove remnants of bond breakers, curing agents, surface grease and oil and construction debris. Contact manufacturer for recommended cleaner and cleaning method.
 2. Apply hardener/densifier per manufacturer's recommended application rate to designated finished floor area, with a low pressure sprayer fitted with a 0.5 gpm spray tip.
 3. Apply sufficient material to wet the surface without producing puddles. Use a clean soft-bristle push broom or microfiber pad to spread the hardener/densifier evenly to achieve uniform wetting. Avoid spreading once drying begins. Surface should remain wet for 5 to 10 minutes. Avoid over-application. (Scrubbing is not necessary) Allow treated surface to dry.
 4. Once thoroughly dry, concrete may be auto-scrubbed, buffed or burnished. Buffing or burnishing should be performed with the appropriate pad.

3.4 PROTECTION

- A. Protect finished floors to prevent damage including staining, gouges and scratching by construction traffic and activities until possession.
- B. Do not drag or drop equipment or material across the slab which will scratch or chip it.
- C. Inspect tires for debris prior to use on slab. Remove embedded items which may cause damage to floor slab..
- D. Clean up spills on slab immediately. Provide cleaning chemicals and absorptive materials.
- E. Develop a concrete protection procedure which addresses the following procedures:
1. Communication of protection plan to subcontractors and vendors.
 2. Procedures for cleaning up slab spills, including use of and availability of cleaning chemicals and absorptive materials at Site.
- F. Provide a clean slab surface using concrete maintenance cleaner within an auto scrubber, equipped with soft nylon brushes, in accordance with manufacturer's recommendations.

3.5 WASTE MANAGEMENT

- A. Separate and dispose of waste in accordance with the Project's Waste Management Plan.

end of section

SECTION 097700 - PERFORATED METAL PANELS

PART 1 - GENERAL

1.1 SUMMARY

A. Work of this Section Includes:

1. Custom-fabricated perforated metal panels installed at restroom entrance vestibules.
2. Accessories: Provide other necessary items including suspension assemblies, devices for attachment, secondary members, splines, splices, connecting clips, connectors, trims, and other devices required for a complete installation.
3. Coordinate layout and installation of items penetrating or being installed into ceiling systems with responsible trades.

B. Related Documents and Sections: Examine Contract Documents for requirements that directly affect or are affected by Work of this Section. A list of those Documents and Sections include, but is not limited to the following:

1. Drawings and general provisions of the Contract, including General and Supplementary Conditions and General Requirements.
2. Section 055000 - METAL FABRICATIONS.

1.2 SUBMITTALS

A. Product Data: Manufacturers product data for each type of product specified in this section.

B. Product Certification: Manufacturer's certifications that products comply with specified requirements and governing codes including product data, laboratory test reports and research reports showing compliance with specified standards.

C. Shop (Coordination) Drawings: Submit shop drawings, drawn to scale, and coordinating penetrations and panel-mounted items. Show the following details:

1. Plan layouts including joint patterns & details.
2. Metal panel suspension system plan with appropriate components, suggested support locations and details.
3. Method of attaching suspension system to building structure.
4. Coordination with: light fixtures, air outlets and inlets, speakers, and other interfaces.
5. Special moldings at ceilings and other junctures with adjoining construction.
6. Framing and support details for work supported by suspension system.
7. List of materials, dimensions, mount locations and any special details.
8. Minimum drawing scale: 1/8" = 1'-0".

9. Provide full scale drawings of perforation patterns. Provide minimum 1"=1'-0" scale layout for each panel type showing perforation layout and orientation as required.
- D. Samples for Verification: Full-size units (or as specified below) of each type of assembly indicated; in sets for each color, texture, and pattern specified, showing the full range of variations expected in these characteristics. Submit samples for each type specified.
 1. 12-inch square, metal panel units.
 2. 12-inch long samples of each exposed molding or trim.
- E. Qualification Data: Provide documents to demonstrate their capabilities and experience. Include lists of at least 5 completed projects with project names and addresses, names and addresses of Architects and employers, and other information specified.

1.3 QUALITY ASSURANCE

- A. Installer:
 1. To certify a minimum 5 years' experience installing similar systems and scope to those specified.
 2. Provide list of at least 5 successful installations with similar products and scope. Include
- B. Manufacturer:
 1. To certify a minimum of 5 years' experience manufacturing similar products to those specified.
 2. Provide support documentation including name and date of project completion. Include names and contact numbers of Architect and employers for reference.
 3. Manufacturer shall be single source and shall be the fabricator and supplier of appropriate major components.
- C. Fire-Test-Response Characteristics: Provide metal panels that comply with one of the following requirements:
 1. Fire-response tests performed by UL, ITS/Warnock Hersey, or another independent testing and inspecting agency that is acceptable to authorities having jurisdiction and that performs testing and follow-up services.
 2. Surface-burning characteristics of acoustical metal panels comply with ASTM E 1264 for Class A materials as determined by testing identical products per ASTM E 84.
- D. Pre-installation Conference: Conduct conference at Project site as directed by the project Architect.

1.4 DELIVERY, STORAGE, AND HANDLING

- A. Deliver metal panel units and suspension system components in original, unopened packages clearly labeled with the following information: name of manufacturing source and location; product type, description and quantity; clients name and shipping address.

- B. Panel's protective layer to be removed only after installation is complete to help prevent panel surface damage.
- C. Store components in a fully enclosed space where they will be protected against physical damage from direct moisture, significant change in humidity, direct sunlight, significant change in temperature, surface contamination, and any other preventable cause.
 - 1. Exercise care in handling components to prevent damage to the surfaces and edges and prevent distortion or other physical damage. Comply with prescribed stacking instructions to

1.5 WARRANTY

- A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of metal wall panel assemblies that fail in materials or workmanship within specified warranty period.
 - 1. Failures include, but are not limited to, the following:
 - a. Structural failures, including rupturing, cracking, or puncturing.
 - b. Deterioration of metals, metal finishes, and other materials beyond normal weathering.
 - 2. Warranty Period: Two years from date of Substantial Completion.
- B. Special Warranty on Panel Finishes: Manufacturer's standard form in which manufacturer agrees to repair finish or replace metal wall panels that show evidence of deterioration of factory-applied finishes within specified warranty period.
 - 1. Fluoropolymer Finish: Deterioration includes, but is not limited to, the following:
 - a. Color fading more than 5 Hunter units when tested according to ASTM D 2244.
 - b. Chalking in excess of a No. 8 rating when tested according to ASTM D 4214.
 - c. Cracking, checking, peeling, or failure of paint to adhere to bare metal.
 - 2. Finish Warranty Period: 10 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. Metal Surfaces, General: Provide materials with smooth, flat surfaces, unless otherwise indicated. For metal fabrications exposed to view in the completed Work, provide materials without seam marks, roller marks, rolled trade names, or blemishes.
- B. Custom-Fabricated Metal Panels (MTL-09):
 - 1. 1/8in thick perforated panels with hairline joints, 50% open, 1/4 in. holes in pattern selected by the Architect, with fluoropolymer coating.
 - 2. Return corners to dimensions indicated.

2.2 METAL SUSPENSION SYSTEMS. GENERAL

- A. Suspension Systems: Provide complete suspensions systems with channels, backer plates, trim molding and other suspension components required to support panels and panel supported construction.
- B. Slotted Channel Framing: Cold-formed metal channels with flange edges returned toward web and with 9/16 inch wide slotted holes in webs at 2 inches o.c.
- C. Attachment Devices: Size for five times design load, unless otherwise indicated:
 - 1. Anchors specified must provide corrosion resistance as per metal type and application.

2.3 FINISHES

- A. General:
 - 1. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.
 - 2. Protect mechanical and painted finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.
 - 3. 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.
- B. Fluoropolymer Three-Coat Finish System: Manufacturer's standard three-coat, thermocured system consisting of specially formulated inhibitive primer, fluoropolymer color coat, and clear fluoropolymer topcoat, with both color coat and clear topcoat containing not less than 70 percent polyvinylidene fluoride resin by weight, with a minimum total dry film thickness of 1.5 mil; complying with AAMA 2605.
 - 1. Color and Gloss: As selected by Engineer from manufacturer's full range.
- C. Suspension System: Furnish matte black finish for entire suspension system, field-apply where required for touchup and fasteners after installation.

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 true to line and level with accurate angles and surfaces and straight edges.
- E. Form exposed connections with hairline joints, flush and smooth, using concealed fasteners where possible. Where exposed fasteners are required, use Phillips flat-head (countersunk) screws or bolts, unless otherwise indicated. Locate joints where least conspicuous.
- F. Fabricate seams and other connections that will be exposed to weather in a manner to exclude water. Provide weep holes where water may accumulate.
- G. Cut, reinforce, drill, and tap metal fabrications as indicated to receive finish hardware, screws, and similar items.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates and structural framing to which acoustical metal panels attach or abut, with Installer present, for compliance with requirements specified in this and other Sections that affect installation and anchorage, and other conditions affecting performance of metal panel systems.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Measure each area and establish layout of metal units to balance border widths at opposite edges of each wall and ceiling area. Avoid using less-than-half-width units at borders, and comply with layout shown on elevation plan layouts.
- B. Survey substrate for attachment of panels to assure squareness and proper elevation for panel installation.

3.3 INSTALLATION

- A. General: Install metal panels per shop drawings provided, per manufacturer's written instructions.
- B. Suspend channels and backer plates from building's approved structural substrates and as follows:
 - 1. Install channels and backer plates plumb and free from contact with other objects within metal panel systems that are not structural support members
 - 2. Space hangers not more than 48 inches on center, along each member supported directly from hangers, unless otherwise indicated; and provide hangers not more than 8 inches from ends of each member. Supply supporting calculations from licensed Structural Engineer verifying mount spacing meets all requirements, when

spacings exceed those recommended.

3. Fine level suspension to 1/8 inch in 10 feet from specified elevation(s), square and true.
 4. Adjust suspension system runners so they are square and securely interlocked with one another. Remove and replace distorted or bent, members.
- C. Install edge moldings and trim of type indicated at perimeter of panels systems and where necessary to conceal edges of metal pans. Method of edge trim attachment and design of edge trims to be approved by Architect.
1. Screw attach moldings to substrate at intervals not more than 18" O.C. and not more than 6" from ends, leveling with suspension system to a tolerance of 1/8" in 10'. Miter corners accurately and connect securely.
 2. Do not use exposed fasteners, including pop rivets, on moldings and trim without prior written approval. Or unless detailed otherwise.
- D. Install metal panel units in coordination with suspension system.
1. Align joints in adjacent courses to form uniform, straight joints parallel to room axis in both directions, unless otherwise indicated. Panel-joints shall flow smoothly and in a straight line within 1/8" in 10'. Intersections shall be continuous.
 2. Fit adjoining units to form flush, tight joints.

3.4 ADJUSTING AND CLEANING

- A. Adjust components to provide a consistent finish and appearance in conformity with established tolerances and requirements.
- B. Clean exposed surfaces of metal panels. Comply with manufacturer's written instructions for cleaning and touchup of minor finish damage.
- C. Remove and replace work that cannot be successfully cleaned and repaired to permanently eliminate evidence of damage, including dented and bent units.

3.5 WASTE MANAGEMENT

- A. Separate and dispose of waste in accordance with the Project's Waste Management Plan.

END OF SECTION

SECTION 099100 - PAINTING

PART 1 - GENERAL

1.1 SUMMARY

- A. Work of this Section consists of surface preparation and field painting of the following:
1. Exposed items and surfaces without factory-applied architectural finish.
 2. Surface preparation, priming, and finish coats specified in this Section are in addition to shop priming and surface treatment specified in other Sections.
 3. Paint exposed surfaces, except where the paint schedules indicate that a surface or material is not to be painted or is to remain natural.
 - a. If the paint schedules do not specifically mention an item or a surface, paint the item or surface the same as similar adjacent materials or surfaces whether or not schedules indicate colors.
 - b. If the schedules do not indicate color or finish, the Architect will select from standard colors and finishes available.
 4. Painting includes field painting of exposed bare and covered pipes and ducts, hangers, exposed steel and ironwork, and primed metal surfaces of mechanical and electrical equipment. Exposed MEP items scheduled in the Finish Schedule shall be painted shall be the same color, unless noted otherwise..
 5. Do not paint prefinished items, concealed surfaces, finished metal surfaces, operating parts, and labels.
 - a. Prefinished items include the following factory-finished components:
 - 1). Architectural woodwork and casework.
 - 2). Acoustical wall panels.
 - 3). Metal toilet enclosures.
 - 4). Metal lockers.
 - 5). Elevator entrance doors and frames.
 - 6). Elevator equipment.
 - 7). Finished mechanical and electrical equipment.
 - 8). Light fixtures.
 - 9). Distribution cabinets.
 - b. Concealed surfaces include walls or ceilings in the following generally inaccessible spaces:
 - 1). Foundation spaces.
 - 2). Furred areas.
 - 3). Ceiling plenums.
 - 4). Utility tunnels.
 - 5). Pipe spaces.
 - 6). Duct shafts.

- 7). Elevator shafts.
 - c. Finished metal surfaces include the following:
 - 1). Prefinished Aluminum: Anodized, or fluoropolymer, silicone-modified polyester (SMP), polyester or acrylic coating system.
 - 2). Stainless steel.
 - 3). Bronze and brass.
 - 4). Galvanized steel, unless noted otherwise.
 - d. Operating parts include moving parts of operating equipment and the following:
 - 1). Valve and damper operators.
 - 2). Linkages.
 - 3). Sensing devices.
 - 4). Motor and fan shafts.
 - e. Labels: Do not paint over Underwriters Laboratories (UL), Factory Mutual (FM), or other code-required labels or equipment name, identification, performance rating, or nomenclature plates.
6. Extra Materials: Provide 1 gallon of each type and color from the same production run as the materials applied in the quantities described below. Package paint materials in unopened, factory-sealed containers for storage and identify with labels describing contents.
- B. Related Documents and Sections: Examine Contract Documents for requirements that directly affect or are affected by Work of this Section. Other Documents and Sections that directly relate to work of this Section include, but are not limited to:
- 1. General provisions of the Contract, including General and Supplementary Conditions, and Division 01 General Requirements Specification Sections.
 - 2. Section 092900 - GYPSUM BOARD.
 - 3. Division 26 - ELECTRICAL.

1.2 SYSTEM DESCRIPTION

- A. References:
- 1. ASTM International.
 - 2. EPA. U. S. Environmental Protection Agency.
 - a. EPA Method 24. Determination of Volatile Matter Content, Water Content, Density, Volume Solids, and Weight Solids of surface coating.
 - 3. Green Seal Certification.
 - 4. PDCA. Painting & Decorating Contractors of America.
- B. Definitions:
- 1. General: Standard coating terms defined in ASTM D16 apply to this Section.
 - 2. Sheen:
 - a. Flat refers to a lusterless or matte finish with a gloss range below 15 when measured at an 85-degree meter.

- b. Eggshell refers to low-sheen finish with a gloss range between 5 and 20 when measured at a 60-degree meter.
 - c. Satin refers to low-sheen finish with a gloss range between 15 and 35 when measured at a 60-degree meter.
 - d. Semi-gloss refers to medium-sheen finish with a gloss range between 30 and 65 when measured at a 60-degree meter.
 - e. Full gloss refers to high-sheen finish with a gloss range more than 65 when measured at a 60-degree meter.
- 3. Aromatic Compounds: Hydrocarbon compounds containing one or more 6-carbon benzene rings in the molecular structure.
 - 4. Paints: Liquid, liquefiable or mastic composition that is converted to a solid protective, decorative, or functional adherent film after application as a thin layer. These coatings are intended for on-site application to interior surfaces of residential, commercial, institutional or industrial buildings.
 - 5. VOC: Volatile Organic Compounds as defined by EPA in 40 CFR § 51.100 (s), (s) (1).

1.3 SUBMITTALS

A. Action Submittals:

- 1. Product Data: Submit manufacturer's printed descriptions of materials, components and systems, performance criteria, use limitations, recommendations and installation information.
 - a. Product Data should indicate coating conforms to federal, state, and local regulations, including VOC compliance with the requirements of this Section.
- 2. Samples:
 - a. Submit to the Architect copies of the full range of colors available in each of the proposed products.
 - b. Upon direction of the Architect, prepare and deliver to the Architect two (2) identical sets of Samples of each of the selected colors and glosses painted onto 8- 1/2" x 11" x 1/4" thick material; whenever possible, the material for the Samples shall be the same material as that on which the coating will be applied in the Work.

B. Informational Submittals:

- 1. Quality Assurance Submittals:
 - a. Test Reports: Submit certified test results by a recognized testing laboratory in accordance with specified test methods for each product and/or system indicating physical, chemical and performance characteristics.
 - b. Certificates: Submit with manufacturer's signature certifying that each product and/or system meets the requirements of the performance characteristics, physical criteria, and applicable standards specified.
 - c. Manufacturer's Field Reports:
 - d. Qualification Statements: Submit a letter, on printed letterhead and signed by an officer of the firm, for each listed quality assurance qualification listed, attesting

to meeting each requirement called out.

1.4 QUALITY ASSURANCE

- A. Installer Qualifications: Perform installation with skilled, experienced and trained workmen supervised by trained personnel who shall have at least three (3) years successful experience in installations of similar size and scope.
- B. Job Mock Up:
 - 1. In addition to the samples specified herein to be submitted for approval, apply in the field, at their final location, each type and color of approved paint materials, applied 10 feet wide, floor to ceiling of wall surfaces, before proceeding with the remainder of the work, for approval by the Architect. Paint mock-ups to include door and frame assembly.
 - 2. These applications when approved will establish the quality and workmanship for the work of this Section.
 - 3. Repaint individual areas which are not approved, as determined by the Architect, until approval is received. Assume at least two paint mock-ups of each color and gloss for approval.
- C. Source Limitations: Obtain block fillers, primers, and undercoat materials for each coating system from the same manufacturer as the finish coats.
- D. Regulatory Requirements:
 - 1. GREENGUARD Environmental Institute (GEI): Indoor Air Quality Certified Products
 - 2. Underwriters Laboratories, Inc. (UL): UL 410 Slip Resistance of Floor Surface Materials.

1.5 DELIVERY, STORAGE AND HANDLING

- A. Deliver materials and products in unopened factory labeled packages. Store and handle in strict compliance with manufacturers' instructions and recommendations. Protect from freezing and damage.
- B. Avoid the possibility of fire by removing flammable materials, solvents and spirits from the project site or by storing materials in UL approved fire-resistive cabinets. Keep work area free from flammable waste and soiled rags.
- C. Sequence deliveries to avoid delays, but minimize on-site storage.

1.6 PROJECT CONDITIONS

- A. Unless specifically pre-approved by the applied product manufacturer, perform no painting or decorating work when the ambient air and substrate temperatures are below 50 deg F for both interior and exterior work.
- B. Perform no exterior painting work unless environmental conditions are within MPI and paint manufacturer's requirements or until adequate weather protection is provided.

Where required, suitable weatherproof covering and sufficient heating facilities shall be in place to maintain minimum ambient air and substrate temperatures for 24 hours before, during and after paint application.

- C. Perform no interior painting or decorating work unless adequate continuous ventilation and sufficient heating facilities are in place to maintain ambient air and substrate temperatures above minimum requirements for 24 hours before, during and after paint application.
 - 1. Provide supplemental ventilating and heating equipment if ventilation and heating from existing system is inadequate to meet minimum requirements.
- D. Perform no painting or decorating work when the relative humidity is above 85% or when the dew point is less than 5 deg F variance between the air / surface temperature.
- E. Perform no painting or decorating work when the maximum moisture content of the substrate exceeds:
 - 1. 12% for concrete and masonry (clay and concrete brick/block).
 - 2. 15% for wood.
 - 3. 12% for plaster and gypsum board.
- F. Conduct moisture tests using a properly calibrated electronic Moisture Meter, except test concrete floors for moisture using a simple cover patch test.
- G. Test concrete, masonry and plaster surfaces for alkalinity as required.
 - 1. Concrete and masonry surfaces must be installed at least 28 days prior to painting and decorating work and must be visually dry on both sides.
- H. Apply paint only to dry, clean, properly cured and adequately prepared surfaces in areas where dust is no longer generated by construction activities such that airborne particles will not affect the quality of finished surfaces.
- I. Ventilation: Comply with manufacturer's requirements and recommendations.
- J. Lighting: Perform no painting or decorating work unless a minimum lighting level of 323 Lux (30 foot candles) is provided on surfaces to be painted or decorated. Adequate lighting facilities shall be provided by the Contractor.

1.7 WARRANTY

- A. Contractor shall warrant installation for a period of two (2) years.
- B. Warranty: Furnish two (2) year written warranty signed by the manufacturer and installer agreeing to repair or replace work which has failed as a result of defects in workmanship. Upon notification within the warranty period, such defects shall be repaired at no cost to the Owner.
 - 1. Contractor shall provide manufacturer's warranty against defective materials for a period of Eight (8) years commencing on Date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Standard Interior Paints:

1. Available Manufacturers: Subject to compliance with design and performance requirements, manufacturers may include but are not limited to the following:
 - a. AFM Enterprises.
 - b. Benjamin Moore Paints.
 - c. BioShield Paint - Eco Design Co.
 - d. Glidden Professional.
 - e. ICI Paints North America.
 - f. PPG Industries.
 - g. Sherwin-Williams Company.
 - h. Wolf Gordon.

2.2 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 Top Coat 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: As indicated in Material Schedule A-831.

2.3 EQUIPMENT

- A. Painting Equipment: to best trade standards for type of product and application.
- B. Spray-Painting Equipment: of ample capacity, suited to the type and consistency of paint or coating being applied and kept clean and in good working order at all times.

2.4 MIXING AND TINTING

- A. Unless otherwise specified or pre-approved, all paints shall be ready-mixed and pre-tinted. Re-mix all paint in containers prior to and during application to ensure break-up of lumps, complete dispersion of settled pigment, and color and gloss uniformity.

- B. Paste, powder or catalyzed paint mixes shall be mixed in strict accordance with manufacturer's written instructions.
- C. Where thinner is used, addition shall not exceed paint manufacturer's recommendations.
- D. If required, thin paint for spraying in strict accordance with paint manufacturer's instructions. If directions are not on container, obtain instructions in writing from manufacturer and provide copy of instructions to Architect.

2.5 FINISH AND COLORS

- A. Unless otherwise specified herein, all painting work shall be in accordance with MPI Premium Grade finish requirements.
- B. Colors shall be as selected by the Architect from a manufacturer's full range of colors. Refer to Room Finish Schedule for identification and location of colors.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates, areas, and conditions, with the Applicator present, under which painting will be performed for compliance with paint application requirements.
 - 1. Do not begin to apply paint until unsatisfactory conditions have been corrected and surfaces receiving paint are thoroughly dry.
 - 2. Start of painting will be construed as the Applicator's acceptance of surfaces and conditions within a particular area.
- B. Coordination of Work: Review other Sections in which primers are provided to ensure compatibility of the total system for various substrates. On request, furnish information on characteristics of finish materials to ensure use of compatible primers.
 - 1. Notify the Architect about anticipated problems using the materials specified over substrates primed by others.

3.2 PREPARATION

- A. General: Remove hardware and hardware accessories, plates, machined surfaces, lighting fixtures, and similar items already installed that are not to be painted. If removal is impractical or impossible because of the size or weight of the item, provide surface-applied protection before surface preparation and painting.
 - 1. After completing painting operations in each space or area, reinstall items removed using workers skilled in the trades involved.
- B. Cleaning: Before applying paint or other surface treatments, clean the substrates of substances that could impair the bond of the various coatings. Remove oil and grease before cleaning.

1. Schedule cleaning and painting so dust and other contaminants from the cleaning process will not fall on wet, newly painted surfaces.
- C. Surface Preparation: Clean and prepare surfaces to be painted according to manufacturer's written instructions for each particular substrate condition and as specified.
1. Provide barrier coats over incompatible primers or remove and reprime.
 2. Cementitious Materials: Prepare concrete, concrete masonry block, cement plaster, and mineral-fiber-reinforced cement panel surfaces to be painted. Remove efflorescence, chalk, dust, dirt, grease, oils, and release agents. Roughen as required to remove glaze. If hardeners or sealers have been used to improve curing, use mechanical methods of surface preparation.
 - a. Use abrasive blast-cleaning methods if recommended by paint manufacturer.
 - b. Determine alkalinity and moisture content of surfaces by performing appropriate tests. If surfaces are sufficiently alkaline to cause the finish paint to blister and burn, correct this condition before application. Do not paint surfaces where moisture content exceeds that permitted in manufacturer's written instructions.
 - c. Clean concrete floors to be painted with a 5 percent solution of muriatic acid or other etching cleaner. Flush the floor with clean water to remove acid, neutralize with ammonia, rinse, allow to dry, and vacuum before painting.
 3. Wood: Clean surfaces of dirt, oil, and other foreign substances with scrapers, mineral spirits, and sandpaper, as required. Sand surfaces exposed to view smooth and dust off.
 - a. Scrape and clean small, dry, seasoned knots, and apply a thin coat of white shellac or other recommended knot sealer before applying primer. After priming, fill holes and imperfections in finish surfaces with putty or plastic wood filler. Sand smooth when dried.
 - b. Prime, stain, or seal wood to be painted immediately on delivery. Prime edges, ends, faces, undersides, and backsides of wood, including cabinets, counters, cases, and paneling.
 - c. When transparent finish is required, backprime with spar varnish.
 - d. Backprime paneling on interior partitions where masonry, plaster, or other wet wall construction occurs on backside.
 - e. Seal tops, bottoms, and cutouts of unprimed wood doors with a heavy coat of varnish or sealer immediately on delivery.
 4. Ferrous Metals: Clean ungalvanized ferrous-metal surfaces that have not been shop coated; remove oil, grease, dirt, loose mill scale, and other foreign substances. Use solvent or mechanical cleaning methods that comply with the Steel Structures Painting Council's (SSPC) recommendations.
 - a. Clean steel surfaces clean as recommended by paint system manufacturer and according to requirements of SSPC-SP series.
 - b. Treat bare and sandblasted or pickled clean metal with a metal treatment wash coat before priming.
 - c. Touch up bare areas and shop-applied prime coats that have been damaged. Wire-brush, clean with solvents recommended by paint manufacturer, and touch up with the same primer as the shop coat.

5. Galvanized Surfaces: Clean galvanized surfaces with nonpetroleum-based solvents so surface is free of oil and surface contaminants. Remove pretreatment from galvanized sheet metal fabricated from coil stock by mechanical methods.
- D. Materials Preparation: Mix and prepare paint materials according to manufacturer's written instructions.
 1. Maintain containers used in mixing and applying paint in a clean condition, free of foreign materials and residue.
 2. Stir material before application to produce a mixture of uniform density. Stir as required during application. Do not stir surface film into material. If necessary, remove surface film and strain material before using.
 3. Use only thinners approved by paint manufacturer and only within recommended limits.
- E. Tinting: Tint each undercoat a lighter shade to simplify identification of each coat when multiple coats of the same material are applied. Tint undercoats to match the color of the finish coat, but provide sufficient differences in shade of undercoats to distinguish each separate coat.

3.3 APPLICATION

- A. Do not paint unless substrates are acceptable and/or until all environmental conditions (heating, ventilation, lighting and completion of other subtrade work) are acceptable for applications of products.
- B. Apply paint or stain in accordance with MPI Painting Manual Premium Grade finish requirements.
- C. Apply paint and decorating material in a workmanlike manner using skilled and trade qualified applicators as noted under Quality Assurance.
- D. Apply paint and coatings within an appropriate time frame after cleaning when environmental conditions encourage flash-rusting, rusting, contamination or the manufacturer's paint specifications require earlier applications.
- E. Painting coats specified are intended to cover surfaces satisfactorily when applied at proper consistency and in accordance with manufacturer's recommendations.
- F. Tint each coat of paint progressively lighter to enable confirmation of number of coats.
- G. Unless otherwise approved by the painting inspection agency, apply a minimum of four coats of paint where deep or bright colors are used to achieve satisfactory results.
- H. Sand and dust between each coat to provide an anchor for next coat and to remove defects visible from a distance up to 1000mm.
- I. Do not apply finishes on surfaces that are not sufficiently dry. Unless manufacturer's directions state otherwise, each coat shall be sufficiently dry and hard before a following coat is applied.
- J. Prime coat of stain or varnish finishes may be reduced in accordance with

manufacturer's directions.

- K. Paint finish shall continue through behind all wall-mounted items (e.g. chalk and tack boards).

3.4 CLEANING

- A. Cleanup: At the end of each workday, remove empty cans, rags, rubbish, and other discarded paint materials from the site.
 - 1. After completing painting, clean glass and paint-spattered surfaces. Remove spattered paint by washing and scraping. Be careful not to scratch or damage adjacent finished surfaces.

3.5 EXTERIOR FINISH / COATING SYSTEMS

- A. Paint exterior surfaces in accordance with the following MPI Painting Manual requirements:
 - 1. CMU Substrates:
 - a. High-Build Latex System: Dry film thickness not less than 10 mils (0.25 mm).
 - 1). Prime Coat: As recommended in writing by topcoat manufacturer.
 - 2). Intermediate Coat: As recommended in writing by topcoat manufacturer.
 - 3). Topcoat: Latex, exterior, high build, MPI #40.
 - 2. Steel Substrates:
 - a. Water-Based Light Industrial Coating System:
 - 1). Prime Coat: Shop primer specified in Section where substrate is specified.
 - 2). Intermediate Coat: Light industrial coating, exterior, water based, matching topcoat.
 - 3). Topcoat: Light industrial coating, exterior, water based, semi-gloss (Gloss Level 5), MPI #163.
 - 3. Galvanized-Metal Substrates:
 - a. Water-Based Light Industrial Coating System:
 - 1). Prime Coat: Primer, galvanized metal, as recommended in writing by topcoat manufacturer for exterior use on galvanized-metal substrates with topcoat indicated.
 - 2). Intermediate Coat: Light industrial coating, exterior, water based, matching topcoat.
 - 3). Topcoat: Light industrial coating, exterior, water based, semi-gloss (Gloss Level 5), MPI #163.
 - 4. Aluminum Substrates:
 - a. Water-Based Light Industrial Coating System:
 - 1). Prime Coat: Primer, quick dry, for aluminum, MPI #95.
 - 2). Intermediate Coat: Light industrial coating, exterior, water based, matching topcoat.

- 3). Topcoat: Light industrial coating, exterior, water based, semi-gloss (Gloss Level 5), MPI #163.
5. Portland Cement Plaster Substrates:
 - a. Latex over Alkali-Resistant Primer System:
 - 1). Prime Coat: Primer, alkali resistant, water based, MPI #3.
 - 2). Intermediate Coat: Latex, exterior, matching topcoat.
 - 3). Topcoat: Latex, exterior flat (Gloss Level 1), MPI #10.

3.6 INTERIOR FINISH / COATING SYSTEMS

- A. Paint interior surfaces in accordance with the following MPI Painting Manual requirements:
 1. GWB (Dry):
 - a. INT 9.2B
 - 1). Prime Coat: Interior latex primer/sealer.
 - 2). Intermediate Coat: High-performance architectural latex matching Top Coat.
 - 3). Top Coat: High-performance architectural latex.
 - a). Sheen: As selected by Architect
 2. GWB (Wet):
 - a. INT 9.2C
 - 1). Prime Coat: Interior latex primer/sealer.
 - 2). Intermediate Coat: Interior alkyd matching Top Coat.
 - 3). Top Coat: Interior alkyd.
 - a). Sheen: As selected by Architect
 3. Metal, Non-galvanized:
 - a. INT 5.1E
 - 1). Prime Coat: Quick-drying alkyd metal primer.
 - 2). Intermediate Coat: Interior alkyd matching Top Coat.
 - 3). Top Coat: Interior alkyd
 - a). Sheen: As selected by Architect.
 - b. Lacquer Finish:
 - 1). Furnish pigmented lacquer finish matching Architect's samples.
 4. Metal, Galvanized:
 - a. INT 5.3E
 - 1). Primer: Vinyl wash.
 - 2). Intermediate Coat: Epoxy.
 - 3). Top Coat: Epoxy finish.
 5. CMU:
 - a. INT 4.2A:
 - b. Block Filler: Block filler, latex, interior/exterior, MPI #4.

- c. Intermediate Coat: Latex, interior, matching topcoat.
- d. Topcoat: Latex, interior (MPI Gloss Level 2), MPI #44.
- 6. Concrete Floors:
 - a. INT 3.2C
 - 1). Topcoat: Epoxy, slip-resistant.
 - 2). Preformed Sanitary Coves: SpeedCove or acceptable equivalent.
 - a). Style and Height: As selected by Architect.

3.7 CLEANING AND PROTECTION

- A. At end of each workday, remove rubbish other discarded materials from Project site.
- B. Protect the work of other trades and work of this Section already installed against soiling and damage by the exercise of reasonable care and precautions. Repair or replace any work so damaged or soiled.
- C. At completion of construction activities of other trades, touch up and restore damaged or defaced coated surfaces.

3.8 WASTE MANAGEMENT

- A. Separate and dispose of waste in accordance with the Project's Waste Management Plan.

END OF SECTION

SECTION 099600 - HIGH-PERFORMANCE COATINGS

PART 1 - GENERAL

1.1 SUMMARY

- A. Work includes but is not limited to following. All work is to be performed in the shop, other than minor touch-ups necessary for a complete installation.
 - 1. Finish coating for exterior ferrous and non-ferrous metal, as indicated.
 - 2. Preparation of surfaces.
 - 3. Inspection, as specified in Section 099100 - PAINTING.
- B. Related Documents and Sections: Examine Contract Documents for requirements that directly affect or are affected by Work of this Section. Other Documents and Sections that directly relate to work of this Section include, but are not limited to:
 - 1. General provisions of the Contract, including General and Supplementary Conditions, and Division 01 General Requirements Specification Sections.
 - 2. Section 055000 - METAL FABRICATIONS.
 - 3. Section 099100 - PAINTING.
- C. Work of this Section is affected by Alternates. Refer to Section 012305 - ARCHITECTURAL ALTERNATES.

1.2 SYSTEM DESCRIPTION

- A. References
 - 1. Applicable provisions of the following standards shall apply to the work of this Section, except as modified herein, and are hereby made a part of these Contract Specifications to the extent required:
 - a. MPI, Master Painters Institute Architectural Painting Specification Manual, latest edition
 - b. SSPC, Steel Structures Painting Council Volume 2: Systems and Specifications
 - 2. Conform to governing regulations including, but not limited to Federal, State, and local requirements.

1.3 SUBMITTALS

- A. Action Submittals:
 - 1. Submit the following in accordance with requirements of Division 01:
 - a. Same as specified in Section 099100 - PAINTING.
- B. Informational Submittals:

1. Qualifications: Applicator qualifications.

1.4 QUALITY ASSURANCE

A. Applicator Qualifications:

1. Employ only qualified journeymen. Apprentices may be employed to work under directions of qualified journeymen, in accordance with trade regulations.
 - a. Submit letter stating last three jobs giving:
 - 1). Start date
 - 2). Completion date
 - 3). Architect
 - 4). Amount of Subcontract cost.
2. Applicator is required to be acceptable to Architect and paint manufacturer and maintain a full, competent crew.

B. Regulatory Requirements: Same as defined in Section 099100 - PAINTING.

C. Painting inspection, same as specified in Section 099100 - PAINTING.

D. Work of Sections 099600 - HIGH-PERFORMANCE COATINGS, and 099100 - PAINTING, to be performed by or under direct supervision of one installer. A pre-application meeting is required between all parties including painting Trade Contractor, Contractor, paint manufacturer's representative, Owner and Architect before work of these sections begin.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Same as specified in Section 099100 - PAINTING, and as required by manufacturer.

1.6 WARRANTY

- A. Same as specified in Section 099100 - PAINTING - 2 years. Note that this is an extension of the one-year warranty.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

- A. Manufacturer and Materials: Tnemec, Carboline, Ameron, Axalta Coating Systems, Sherwin-Williams, or acceptable equivalent.
- B. Except as otherwise indicated, Basis for Design are products and systems by Tnemec, and cited herein for type, quality and performance.

2.2 PAINT SYSTEMS

- A. Three Coat System for Exterior Steel: Provide the following shop-applied system, or equivalent system acceptable to the Architect by another named manufacturer:
 - 1. Surface Preparation: SSPC-SP6 Commercial Blast, angular surface profile of 1 mil.
 - 2. Tnemec System:
 - a. Coat 1: Tnemec Zinc-rich primer 94-H2O
 - b. Coat 2: Tnemec Epoxy 66-HS
 - c. Coat 3: Tnemec Semi-gloss 10-95 or High-gloss 10-94
 - 3. Colors: As selected by the Architect from manufacturer's entire line, including deep tones.
- B. Four coat system at exterior diamond plate floors to create a non-slip surface.
 - 1. Surface Preparation: SSPC-SP6 Commercial Blast Cleaning.
 - 2. Tnemec System:
 - a. Coat 1: Tnemec Series 394 PerimePrime at 2.5-3.5 mils DFT (shop applied)
 - b. Coat 2: Tnemec Series 161HS Tnemec Fascure Epoxy at 4-6 mils DFT
 - c. Coat 3: Tnemec Series 161HS Tnemec Fascure Epoxy at 4-6 mils DFT (with glass beads broadcast for texture)
 - d. Coat 4: Tnemec Series 290 CRU polyurethane, at 2-3 mils DFT.
 - 3. Colors: As selected by the Architect from manufacturer's entire line, including deep tones.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Verify installation conditions as satisfactory to receive work of this Section. Do not install until unsatisfactory conditions are corrected. Beginning work constitutes acceptance of conditions as satisfactory.

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 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 coatings, 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 coating systems indicated.
- D. Prepare surfaces as recommended by manufacturer and following:
1. SSPC SP-6, Commercial Blast Cleaning. Prime by end of same work day and before forming of any visible rust.
- 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.

3.3 APPLICATION

- A. Apply the work in strict conformance with manufacturer's directions.

3.4 PATCHING

- A. At completion of work, repair surfaces damaged by other trades and requiring touch-up or refinishing. Repaint entire surface as needed to provide uniform finish, color, and appearance.

3.5 TOUCH UP PAINTING

- A. Immediately after erection, clean field welds, bolted connections, and abraded areas of shop paint in accordance with SSPC-SP11. Apply paint to exposed areas using same material as used for shop painting.

3.6 FIELD QUALITY CONTROL

- A. Same as specified in Section 099100 - PAINTING.
- B. Film Thickness Tests; as directed:
1. Use suitable wet film gauge, verify mil thicknesses, in selected locations.
 2. Test surfaces with Tooke or approved dry film gauge, for total dry film thicknesses.

3.7 CLEANING AND PROTECTION

- A. At end of each workday, remove rubbish other discarded materials from Project site.
- B. Protect the work of other trades and work of this Section already installed against soiling and damage by the exercise of reasonable care and precautions. Repair or replace any work so damaged or soiled.
- C. At completion of construction activities of other trades, touch up and restore damaged or defaced coated surfaces.

3.8 WASTE MANAGEMENT

- A. Separate and dispose of waste in accordance with the Project's Waste Management Plan.

END OF SECTION

SECTION 101419 - DIMENSIONAL LETTER SIGNAGE

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Cutout dimensional characters.

1.2 SUBMITTALS

- A. Product Data: For each type of product.
- B. Shop Drawings: For 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, and layout for each sign at least half size.
- C. Samples for Verification: For each type of sign assembly showing all components and with the required finish(es), in manufacturer's standard size unless otherwise indicated and as follows:
 - 1. Dimensional Characters: Full-size Samples of three dimensional character.
 - 2. Full-size Samples, if approved, will be returned to Contractor for use in the Project.
- D. Product Schedule: For dimensional letter signs. Use same designations indicated on Drawings or specified.
- E. Closeout Submittals
 - 1. Maintenance Data: For signs to include in maintenance manuals.

1.3 QUALITY ASSURANCE

- A. The following items are required for quality assurance, and shall be made available to the Architect if requested:
 - 1. Qualification Data: For Installer and manufacturer.
 - 2. Sample Warranty: For special warranty.
- B. Installer Qualifications: An entity that employs installers and supervisors who are trained and approved by manufacturer.

1.4 FIELD CONDITIONS

- A. Field Measurements: Verify locations of electrical service embedded in permanent construction by other installers by field measurements before fabrication, and indicate measurements on Shop Drawings.

1.5 WARRANTY

- A. Special Warranty: Manufacturer agrees to repair or replace components of signs that fail in materials or workmanship within specified warranty period.
 - 1. Failures include, but are not limited to, the following:
 - a. Deterioration of finishes beyond normal weathering.
 - 2. Warranty Period: Five years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 DIMENSIONAL CHARACTERS

- A. Cutout Characters: Characters with uniform faces; square-cut, smooth, eased edges; precisely formed lines and profiles; and as follows:
 - 1. Character Material: Sheet or plate steel
 - 2. Character Height: As indicated on Drawings.
 - 3. Thickness: As indicated on Drawings.
 - 4. Finishes:
 - a. Baked-Enamel or Powder-Coat Finish: Manufacturer's standard, in color as indicated by manufacturer's designation.
 - b. Overcoat: Manufacturer's standard baked-on clear coating.
 - 5. Mounting: As indicated on Drawings.
 - 6. Typeface: As selected by the Architect.

2.2 DIMENSIONAL CHARACTER MATERIALS

- A. Steel Sheet: Uncoated, cold-rolled, ASTM A1008, commercial steel.
- B. Paints and Coatings for Sheet Materials: Paints that are recommended by manufacturer for optimum adherence to surface and are UV and water resistant for colors and exposure indicated.

2.3 ACCESSORIES

- A. Fasteners and Anchors: Manufacturer's standard as required for secure anchorage of signs, noncorrosive and compatible with each material joined, and complying with the following:
 - 1. Use concealed fasteners and anchors unless indicated to be exposed.

2. For exterior exposure, furnish stainless-steel devices unless otherwise indicated.
3. Sign Mounting Fasteners:
 - a. Projecting Studs: Threaded studs with sleeve spacer, welded or brazed to back of sign material, screwed into back of sign assembly, or screwed into tapped lugs cast integrally into back of cast sign material, unless otherwise indicated.

2.4 FABRICATION

- A. General: Provide manufacturer's standard sign assemblies according to requirements indicated.
 1. Preassemble signs and assemblies in the shop to greatest extent possible. Disassemble signs and assemblies only as necessary for shipping and handling limitations. Clearly mark units for reassembly and installation; apply markings in locations concealed from view after final assembly.
 2. Mill joints to a tight, hairline fit. Form assemblies and joints exposed to weather to resist water penetration and retention.
- B. Brackets: Fabricate brackets, fittings, and hardware for bracket-mounted signs to suit sign construction and mounting conditions indicated. Modify manufacturer's standard brackets as required.

2.5 FINISH REQUIREMENTS

- A. Appearance of Finished Work: Noticeable variations in same piece are not acceptable. Variations in appearance of adjoining components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.
- B. Baked-Enamel or Powder-Coat Finish: AAMA 2603 except with a minimum dry film thickness of 1.5 mils (0.04 mm). Comply with coating manufacturer's written instructions for cleaning, conversion coating, and applying and baking finish.

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 signage work.
- B. Verify that sign-support surfaces are within tolerances to accommodate signs without gaps or irregularities between backs of signs and support surfaces unless otherwise indicated.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 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. Before installation, verify that sign surfaces are clean and free of materials or debris that would impair installation.
- B. Mounting Methods:
 - 1. Projecting Studs: Using a template, drill holes in substrate aligning with studs on back of sign. Remove loose debris from hole and substrate surface.
 - a. Thin or Hollow Surfaces: Place spacers on studs, place sign in position with spacers pinched between sign and substrate, and install washers and nuts on stud ends projecting through opposite side of surface, and tighten.

3.3 ADJUSTING AND CLEANING

- A. Remove and replace damaged or deformed characters and signs that do not comply with specified requirements. Replace characters with damaged or deteriorated finishes or components that cannot be successfully repaired by finish touchup or similar minor repair procedures.
- B. Remove temporary protective coverings and strippable films as signs are installed.
- C. On completion of installation, clean exposed surfaces of signs according to manufacturer's written instructions, and touch up minor nicks and abrasions in finish. Maintain signs in a clean condition during construction and protect from damage until acceptance by Owner.

END OF SECTION

SECTION 101423 - CODE REQUIRED SIGNAGE

PART 1 - GENERAL

1.1 SUMMARY

- A. Work of this Section consists of signage but is not limited to the following:
 - 1. Interior statutory signage.
- B. Related Documents and Sections: Examine Contract Documents for requirements that directly affect or are affected by Work of this Section. Other Documents and Sections that directly relate to work of this Section include, but are not limited to:
 - 1. General provisions of the Contract, including General and Supplementary Conditions, and Division 01 General Requirements Specification Sections.
 - 2. Section 033000 - CAST-IN-PLACE CONCRETE.
 - 3. Section 055000 - METAL FABRICATIONS.
 - 4. Section 099100 - PAINTING.

1.2 SUBMITTALS

- A. Product Data: Submit manufacturer's product data, installation instructions, use limitations and recommendations for each material used. Provide certifications stating that materials comply with requirements. Manufacturers shall have at least five years' experience in the manufacture of sign systems specified.
- B. Initial Selection Samples: Submit samples showing complete range of colors, textures, and finishes available for each material used.
- C. Shop Drawings: Submit fabrication and assembly drawings indicating materials, piece quantities and dimensions, each piece surface finish, assembly configuration, erection sequence, piece numbering, specific attachments and attachment requirements.
 - 1. Drawings for installed products indicated to comply with design loads, include structural analysis data signed and sealed by the qualified professional engineer responsible for their preparation.
 - 2. Field Measurements: Indicate verified field measurements on the Shop Drawings.

1.3 QUALITY ASSURANCE

- A. Qualifications:
 - 1. Manufacturer Qualifications: A firm experienced a minimum five (5) years in manufacturing products or systems similar to those indicated for this Project and with a record of successful in-service performance.
 - 2. Installer Qualifications: Perform installation with skilled, experienced and trained

workmen supervised by trained personnel who shall have at least three (3) years successful experience in installations of similar size and scope.

- B. Source: For each type of material required for the work of this section, provide primary materials which are the products of one manufacturer. Provide secondary materials which are acceptable to the manufacturers of the primary materials.
- C. Regulatory Requirements:
 - 1. ADA Requirements: Comply with State of North Carolina requirements and Americans with Disabilities Act requirements, including Type 2 Braille.
 - 2. Egress components integrated into stairs and landings. Install in accordance with manufacturer's recommendations and to comply with Local Law 26 and RS 6-1.
- D. Pre-installation Meeting: Purpose is to review installation procedures and warranty requirements.

1.4 DELIVERY, STORAGE AND HANDLING

- A. Deliver materials and products in unopened factory labeled packages. Store and handle in strict compliance with manufacturer's instructions and recommendations. Protect from damage.
- B. Sequence deliveries to avoid delays, but minimize on-site storage.

1.5 SEQUENCING AND SCHEDULING

- A. Delay installation of work of this section until near time of Substantial Completion.

1.6 WARRANTY

- A. Contractor shall warrant installation for a period of one (1) year.
 - 1. Provide manufacturer's standard one (1) year warranty against defects in fabrication and finishes.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. Acrylic Sheet: ASTM D 4802, Category A-1 (cell-cast sheet), Type UVA (UV absorbing).

2.2 MANUFACTURERS

- A. Provide products of one of the following manufacturers if they meet or exceed the requirements of these specifications:
 - 1. Andco Industries.

2. Cornelius.
3. Gemini, Inc.
4. Lynn Sign Company.
5. Mohawk Engraving Company.
6. The Supersine Company.

2.3 INTERIOR SIGNS

- A. Laminated Sheet: High-pressure engraved stock with contrasting color face laminated to acrylic core as selected by Architect from manufacturer's full range.
 1. Tactile Characters: Grade 2 Braille raised 1/32 inch above surface with contrasting colors.
 - a. Room Designation Signs.
 - b. ADA Bathroom Signs.
 - c. Room Maximum Capacity Indications for assembly spaces.

2.4 PHOTOLUMINESCENT MARKERS

- A. Photo-luminescent Strips: Furnish photo-luminescent adhesive strips applied to stair treads and stair corridor surfaces to match existing and in compliance with Local Law 26.
 1. Reference Product: EverGlow Tamper Resistant Tape, or an acceptable equivalent.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Carefully examine installation areas with Installer present, for compliance with requirements affecting Work performance.
 1. Verification of Conditions: Verify that field measurements, surfaces, substrates, structural support, utility connections, tolerances, levelness, plumbness, humidity, moisture content level, cleanliness and other conditions are as required by the manufacturer, and ready to receive Work.
 2. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Prepare substrate(s) in accordance with manufacturer's instructions, which may include the following:
 1. Remove coating to allow for proper bonding.
 2. Texture surface to allow for proper bonding.
 3. Clean surfaces.
 4. Coat substrate when necessary to protect from galvanic action, separating dissimilar

metal materials.

5. Framing, blocking or other necessary structural reinforcement.

3.3 INSTALLATION

- A. Install in strict accordance with applicable accessibility code and law, the approved shop drawings, and manufacturer's written instructions and recommendations.

3.4 WASTE MANAGEMENT

- A. Separate and dispose of waste in accordance with the Project's Waste Management Plan.

3.5 WASTE MANAGEMENT

- A. Separate and dispose of waste in accordance with the Project's Waste Management Plan.

END OF SECTION

SECTION 102113 - TOILET COMPARTMENTS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Solid-polymer toilet compartments configured as toilet enclosures and urinal screens.

B. Related Documents and Sections: Examine Contract Documents for requirements that directly affect or are affected by Work of this Section. Other Documents and Sections that directly relate to work of this Section include, but are not limited to:

1. General provisions of the Contract, including General and Supplementary Conditions, and Division 01 General Requirements Specification Sections.
2. Section 055000 - METAL FABRICATIONS.
3. Section 061053 - MISCELLANEOUS ROUGH CARPENTRY.
4. Section 092900 - GYPSUM BOARD.
5. Section 102813 - TOILET ACCESSORIES.

1.2 SUBMITTALS

A. Product Data: For each type of product.

1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for toilet compartments.

B. Shop Drawings: Include plans, elevations, sections, details, and attachments to other work.

1. Show locations of reinforcements for compartment-mounted grab bars.
2. Show ceiling grid, ceiling-mounted items, and overhead support or bracing locations.

C. Samples for Verification: Of each type of color and finish required for units, prepared on 6-inch- square Samples of same thickness and material indicated for Work.

D. Product Certificates: For each type of toilet compartment.

E. Quality Assurance Submittals:

1. Certificates: Submit with manufacturer's signature certifying that each product meets the requirements of the performance characteristics, physical criteria, and applicable standards specified.
2. Qualification Statements: Submit a letter, on printed letterhead and signed by an officer of the firm, for each listed quality assurance qualification listed, attesting to

meeting each requirement called out.

- F. Maintenance Material Submittals: Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
 - 1. Door Hinges: One hinge(s) with associated fasteners.
 - 2. Latch and Keeper: One latch(es) and keeper(s) with associated fasteners.
 - 3. Door Bumper: One door bumper(s) with associated fasteners
 - 4. Door Pull: One door pull(s) with associated fasteners.
 - 5. Fasteners: Ten fasteners of each size and type.
- G. Maintenance Data: For toilet compartments to include in maintenance manuals.

1.3 QUALITY ASSURANCE

- A. Qualifications:
 - 1. Fabricator Qualifications: A firm experienced a minimum five (5) years in producing products similar to those indicated for this Project and with a record of successful in-service performance, as well as sufficient production capacity to produce required units.
 - 2. Installer Qualifications: Perform installation with skilled, experienced and trained workmen supervised by trained personnel who shall have at least three (3) years successful experience in installations of similar size and scope.
- B. Regulatory Requirements:
 - 1. Hardware: Hardware shall comply with ANSI A117.1 and Title III of the Americans with Disabilities Act (ADA) as follows:
 - a. Metal, Stainless Steel:
 - 1). Hinges: Supply gravity-acting cam allowing doors to be set at various positions
 - 2). Latch and Keeper: Slide latch and combination stop with emergency release.
 - 2. Surface Burning Requirements: Fabricate compartments from panels which are UL classified and labeled.

1.4 PROJECT CONDITIONS

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

1.5 WARRANTY

- A. Contractor shall warrant installation for a period of one (1) year from date of substantial completion.
 - 1. Manufacturer shall guarantee its solid plastic HDPE material against breakage, corrosion, and delamination for 15 years from the date of receipt by the customer. If material is found defective during that period, the material shall be replaced free of charge. No credits or allowances shall be issued for any labor or expenses relating to the replacement of components covered under the warranty plan.

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: 75 or less.
 - 2. Smoke-Developed Index: 450 or less.
- B. Regulatory Requirements: Comply with applicable provisions in the U.S. Architectural & Transportation Barriers Compliance Board's ADA-ABA Accessibility Guidelines for Buildings and Facilities and ICC A117.1 for toilet compartments designated as accessible.

2.2 TOILET PARTITIONS (A-07)

- A. Basis-of-Design: Provide Eclipse by Scranton products, or equivalent by one of the following:
 - 1. Bobrick.
 - 2. Hadrian.
- B. Toilet Compartment Types:
 - 1. Floor mounted, overhead braced.

2.3 MATERIALS

- A. Doors, Panels and Pilasters: Shall be constructed from 100% recycled High Density Polyethylene (HPDE) resins, pressed under high pressure, forming a single component. The material shall be waterproof, non-absorbent and have a self-lubricating surface that resists marks from graffiti.
 - 1. Door, panel and pilaster shall be 1 inch thick and have edges rounded to a 3/16 inch radius.
 - 2. Doors and panels shall be 66 inches high and mounted at 8 inches above the finished floor. An aluminum heat sink strip shall be fastened to the bottom edge of

doors and panels.

3. Pilasters shall be full height and shall be rigidly anchored.
 4. Urinal screens shall have the same construction as doors, panels and pilasters. Urinal screens shall be 42 inch high and mounted at 18 inches above the finished floor.
 5. Color: As selected by Architect from available 100 percent post-consumer recycled HDPE colors.
- B. Hardware and Accessories: Manufacturer's standard design, heavy-duty operating hardware and accessories.
1. Material: Stainless steel Type 304, #4 satin finish.
 2. Material: Aluminum extrusion 6463-T5 Alloy, bright-dipped anodized finish.
- C. Anchorages and Fasteners: Manufacturer's standard exposed fasteners of stainless steel or chrome-plated steel or brass, finished to match hardware, with theft-resistant-type heads. Provide sex-type bolts for through-bolt applications. For concealed anchors, use hot-dip galvanized or other rust-resistant, protective-coated steel.
1. Fasteners: Pre-packed, marked and labeled for ease of identification.
- D. Pilaster Shoes and Caps:
1. Stainless steel, ASTM A666, Type 302 or 304, not less than 0.0312 inch specified thickness and 3 inches high, finished to match hardware.
- E. Brackets (Fittings):
1. Continuous Type: Manufacturer's standard design:
 - a. Aluminum.

2.4 SOLID PLASTIC TOILET COMPARTMENTS AND SCREENS

- A. Doors and Panels: High density polyethylene (HDPE), fabricated from extruded polymer resins, forming single thickness panel.
1. Waterproof and nonabsorbent, with self-lubricating surface, resistant to marks by pens, pencils, markers, and other writing instruments.
 2. Thickness: 1 inch (25 mm).
 3. Edges: Shiplap.
- B. Doors and Dividing Panels:
1. High Privacy:
 - a. Height: 58 inches high and mounted at 12 inches above the finished floor.
 - b. Doors: shiplap edge opposite hinge side. Straight cut edge on hinge side.
 - c. Dividing Panels: Two panels stacked and secured with 3 dowels ensuring proper alignment totaling the system specified height
- C. Metal Posts: 82.75 inches (2102 mm) high, heavy duty extruded aluminum, clear

anodized finish, fastened to foot with stainless steel tamper resistant screw.

- D. Hidden Shoe (Foot): One-piece molded polyethylene invisible shoe inserted into metal post and secured to metal post with stainless steel tamper resistant screw.
- E. Headrail Cap and Corner Cap: One-piece molded polyethylene secured to metal post with stainless steel tamper resistant screw; adjustable to level headrail to finished floor.
- F. Wall brackets: wall brackets shall be made of heavy-duty aluminum 6463-T5 alloy.
 - 1. Length: 59 inches.
- G. Headrail: Heavy duty extruded aluminum, designer anti-grip design, clear anodized finish, fastened to headrail bracket with stainless steel tamper resistant screw and to headrail cap or corner cap with stainless steel tamper resistant screw.
 - 1. Headrail Brackets: injection molded polyethylene.
- H. Hinges:
 - 1. Edge-mounted stainless steel continuous hinge.
- I. Occupancy Indicator Latch and Housing: Satin stainless-steel showing green and red occupancy indicators.
 - 1. Latch Housing: Satin stainless steel
 - 2. Slide Bolt And Button: Satin stainless steel
- J. Door Pulls: satin stainless steel
- K. Door Stop: Coat hook bumper.

2.5 FABRICATION

- A. Fabrication, General: Fabricate toilet compartment components to sizes indicated. Coordinate requirements and provide cutouts for through-partition toilet accessories where required for attachment of toilet accessories.
- B. Floor-Anchored Units: Provide manufacturer's standard corrosion-resistant anchoring assemblies with leveling adjustment nuts at pilasters for structural connection to floor. Provide shoes at pilasters to conceal anchorage.
- C. Door Size and Swings: Unless otherwise indicated, provide 24-inch- wide, in-swinging doors for standard toilet compartments and 36-inch- wide, out-swinging doors with a minimum 32-inch- wide, clear opening for compartments designated as accessible.

PART 3 - EXECUTION

3.1 PROJECT CONDITIONS

- A. Field Measurements: Verify actual locations of walls, columns, ceilings, and other

construction contiguous with toilet compartments by field measurements before fabrication and indicate measurements on Shop Drawings.

1. Established Dimensions: Where field measurements cannot be made without delaying the Work, establish dimensions and proceed with fabricating toilet compartments without field measurements. Coordinate wall, floor, ceilings, and other contiguous construction to ensure that actual dimensions correspond to established dimensions.

3.2 EXAMINATION

- A. Carefully examine areas with Installer present, for compliance with requirements affecting Work performance.
 1. Verification of Conditions: Verify that field measurements, surfaces, substrates, structural support, utility connections, tolerances, levelness, plumbness, humidity, moisture content level, cleanliness and other conditions are as required by the manufacturer, and ready to receive Work.
 2. Proceed with installation only after unsatisfactory conditions have been corrected.

3.3 INSTALLATION

- A. General: Comply with manufacturer's written installation instructions. Install units rigid, straight, level, and plumb. Secure units in position with manufacturer's recommended anchoring devices.
 1. Maximum Clearances:
 - a. Pilasters and Panels: 3/8 inch.
 - b. Panels and Walls: 1/2 inch.
 2. Continuous Brackets: Where indicated, provide continuous brackets for panel-to-panel and panel-to-wall connections.
- B. Floor-Anchored Units: Set pilasters with anchors penetrating not less than 2 inches into structural floor unless otherwise indicated in manufacturer's written instructions. Level, plumb, and tighten pilasters. Hang doors and adjust so tops of doors are level with tops of pilasters when doors are in closed position.
- C. Wall-Hung Urinal Screens: Attach with anchoring devices to suit supporting structure. Set units level and plumb and to resist lateral impact.

3.4 CLEANING AND PROTECTION

- A. At end of each workday, remove rubbish other discarded materials from Project site.
- B. Protect the work of other trades and work of this Section already installed against soiling and damage by the exercise of reasonable care and precautions. Repair or replace any work so damaged or soiled.
- C. At completion of construction activities of other trades, touch up and restore damaged

or defaced coated surfaces.

3.5 WASTE MANAGEMENT

- A. Separate and dispose of waste in accordance with the Project's Waste Management Plan.

END OF SECTION

SECTION 102239 - OPERABLE PANEL PARTITIONS

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Manually operated, acoustical panel partitions.
- B. Related Documents and Sections: Examine Contract Documents for requirements that directly affect or are affected by Work of this Section. A list of those Documents and Sections include, but is not limited to the following:
 - 1. Drawings and general provisions of the Contract, including General and Supplementary Conditions, and Division 01 General Requirements Specification Sections, apply to this Section.
 - 2. Section 055000 - METAL FABRICATIONS.
 - 3. Section 092900 - GYPSUM BOARD.
 - 4. Division 26, ELECTRICAL.

1.2 SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Shop Drawings: Include plans, elevations, sections, details, and attachments to other work.
 - 1. Indicate storage and operating clearances. Indicate location and installation requirements for hardware and track, blocking, and direction of travel.
 - 2. Include reflected ceiling plans, drawn to scale, on which the following items are shown and coordinated with each other, based on input from installers of the items involved:
 - a. Suspended ceiling components.
 - b. Structural members to which suspension systems will be attached.
 - c. Items penetrating finished ceiling, including the following:
 - 1). Lighting fixtures.
 - 2). HVAC ductwork, outlets, and inlets.
 - 3). Speakers.
 - 4). Sprinklers.
 - 5). Smoke detectors.
 - 6). Access panels.
- C. Samples for Verification: For each type of exposed material, finish, covering, or facing indicated, prepared on Samples of size indicated below:

1. Textile: Full width by not less than 36-inch- long section of fabric from dye lot to be used for the Work, with specified treatments applied. Show complete pattern repeat.
 2. Panel Facing Material: Manufacturer's standard-size unit, not less than 3 inches square.
 3. Panel Edge Material: Not less than 6 inches long.
 4. Hardware: Manufacturer's standard exposed door-operating device.
- D. Setting Drawings: For embedded items and cutouts required in other work, including support-beam, mounting-hole template.
- E. Qualification Data: For qualified Installer.
- F. Product Certificates: For each type of operable panel partition, from manufacturer.
- G. Product Test Reports: Based on evaluation of comprehensive tests performed by a qualified testing agency, for each operable panel partition.
1. Demonstrate compliance with specified NIC in installed systems.
- H. Operation and Maintenance Data: For operable panel partitions to include in maintenance manuals. Include the following:
1. Panel finish facings and finishes for exposed trim and accessories. Include precautions for cleaning materials and methods that could be detrimental to finishes and performance.
 2. Seals, hardware, track, carriers, and other operating components.
- I. Warranty: Sample of special warranty.

1.3 QUALITY ASSURANCE

- A. Installer Qualifications: An employer of workers trained and approved by manufacturer.
- B. Fire-Test-Response Characteristics: Provide panels with finishes meeting one of the following as determined by testing identical products by UL or another testing and inspecting agency acceptable to authorities having jurisdiction:
1. Surface-Burning Characteristics: As determined by testing per ASTM E 84.
 - a. Flame-Spread Index: 25 or less.
 - b. Smoke-Developed Index: 450 or less.
 2. Fire Growth Contribution: Meeting acceptance criteria of local code and authorities having jurisdiction when tested according to NFPA 265.
- C. Preinstallation Conference: Conduct conference at Project site.

1.4 PROJECT CONDITIONS

- A. Field Measurements: Verify actual dimensions of operable panel partition openings by field measurements before fabrication.

1.5 WARRANTY

- A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of operable panel partitions that fail in materials or workmanship within specified warranty period.
 - 1. Failures include, but are not limited to, the following:
 - a. Faulty operation of operable panel partitions.
 - b. Deterioration of metals, metal finishes, and other materials beyond normal wear.
 - 2. Warranty Period: Two years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Acoustical Performance: Provide operable panel partitions tested by a qualified testing agency for the following acoustical properties according to test methods indicated:
 - 1. Sound-Transmission Requirements: Operable panel partition assembly tested for laboratory sound-transmission loss performance according to ASTM E 90, determined by ASTM E 413, and rated for not less than the STC indicated.
- B. Fire Resistance: Provide fire-rated operable panel partition assemblies complying with NFPA 80, based on testing according to UL 10B for fire-rated door assemblies.
- C. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

2.2 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. Modernfold, Inc.
 - 2. Hufcor, Inc.
 - 3. Panelfold Inc.
- B. Basis-of-Design Product: Acousti-Seal 932 Operable Partition by Modernfold, Inc., manually operated paired panel operable partition, top supported with operable floor seals.
 - 1. System includes operable panel partition system, including panels, seals, finish facing, suspension system, and accessories.
 - 2. Final Closure: Horizontally expanding panel edge with removable crank

2.3 MATERIALS

- A. Steel Frame: Steel sheet, manufacturer's standard nominal minimum thickness for uncoated steel.
- B. Steel Face/Liner Sheets: Tension-leveled steel sheet, manufacturer's standard nominal minimum thickness for uncoated steel.
- C. Aluminum: Alloy and temper recommended by aluminum producer and finisher for type of use, corrosion resistance, and finish indicated; ASTM B 221 for extrusions; manufacturer's standard strengths and thicknesses for type of use.
 - 1. Frame Reinforcement: Manufacturer's standard steel or aluminum.

2.4 PANEL CONSTRUCTION

- A. Nominal 3-inch thick panels; refer to the Drawings for required widths. All panel horizontal and vertical framing members fabricated from minimum 18-gage formed steel with overlapped and welded corners for rigidity. Top channel is reinforced to support suspension system components. Frame is designed so that full vertical edges of panels are of formed steel and provide concealed protection of the edges of the panel skin.
- B. Panel skin shall be:
 - 1. Roll-formed steel wrapping around panel edge. Panel skins shall be lock formed and welded directly to the frame for unitized construction. Acoustical ratings of panels with this construction minimum:
 - a. 50 STC
- C. Hinges for Panels, Closure Panels, and Pocket Doors shall be:
 - 1. Full leaf butt hinges, attached directly to the panel frame with welded hinge anchor plates within panel to further support hinge mounting to frame. Lifetime warranty on hinges. Hinges mounted into panel edge or vertical astragal are not acceptable.
- D. Panel Trim: No vertical or horizontal trim required or allowed on edges of panels; minimal groove appearance at all panel joints.
- E. Panel Weight: 11 lbs./square foot

2.5 PANEL FINISH

- A. Panel finish shall be factory applied, Class "A" rated material. Finish shall be fabric, as selected by the Architect from manufacturer's standard range.
- B. Panel Trim: Exposed panel trim of one consistent color:
 - 1. As selected by Architect.

2.6 SOUND SEALS

- A. Vertical Interlocking Sound Seals between panels: Roll-formed steel astragals, with reversible tongue and groove configuration in each panel edge for universal panel operation. Rigid plastic astragals or astragals in only one panel edge are not acceptable.
- B. Horizontal Top Seals: Continuous contact extruded vinyl bulb shape with pairs of non-contacting vinyl fingers to prevent distortion without the need for mechanically operated parts.
- C. Horizontal bottom floor seals shall be manual operable bottom seals with removable handle. Seal shall be operable from panel edge or face.

2.7 SUSPENSION SYSTEM

- A. Suspension Tracks: Minimum 11-gauge, 0.12-inch roll-formed steel track, suitable for either direct mounting to a wood header or supported by adjustable steel hanger brackets, supporting the load-bearing surface of the track, connected to structural support by pairs of 0.38-inch diameter threaded rods. Aluminum track is not acceptable.
 - 1. Exposed track soffit: Steel, integral to track, and pre-painted off-white.
 - 2. Carriers: One all-steel trolley with steel tired ball bearing wheels per panel (except hinged panels). Non-steel tires are not acceptable.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine flooring, structural support, and opening, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of operable panel partitions.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

- A. General: Comply with ASTM E 557 except as otherwise required by operable panel partition manufacturer's written installation instructions.
- B. Install operable panel partitions and accessories after other finishing operations, including painting, have been completed.
- C. Broken, cracked, chipped, deformed, or unmatched panels are not acceptable.
- D. Broken, cracked, deformed, or unmatched gasketing or gasketing with gaps at butted ends is not acceptable.

3.3 ADJUSTING

- A. Adjust operable panel partitions to operate smoothly, without warping or binding. Lubricate hardware and other moving parts.

3.4 FIELD QUALITY CONTROL

- A. Light-Leakage Test: Prior to NIC testing, illuminate one side of partition installation and observe vertical joints and top and bottom seals for voids; adjust partitions for acceptable fit.
- B. NIC Testing: Owner will engage a qualified testing agency to perform tests and inspections.
- C. Testing Methodology: Perform testing of installed operable panel partition for noise isolation according to ASTM E 336, determined by ASTM E 413, and rated for not less than NIC indicated. Adjust and fit partitions to comply with NIC test method requirements.
- D. Testing Extent: Testing agency shall test each operable panel partition installation.
- E. Repair or replace operable panel partitions that do not comply with requirements.
- F. Additional testing and inspecting, at Contractor's expense, will be performed to determine compliance of repaired, replaced, or additional work with specified requirements.
- G. Prepare test and inspection reports.

3.5 CLEANING

- A. Clean soiled surfaces of operable panel partitions to remove dust, loose fibers, fingerprints, adhesives, and other foreign materials according to manufacturer's written instructions.

3.6 DEMONSTRATION

- A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain operable panel partitions.

3.7 WASTE MANAGEMENT

- A. Separate and dispose of waste in accordance with the Project's Waste Management Plan.

END OF SECTION

SECTION 102800 - TOILET ACCESSORIES

PART 1 - GENERAL

1.1 SUMMARY

- A. Work of this Section consists of toilet accessories, as indicated on the drawings and specified herein,
- B. Related Documents and Sections: Examine Contract Documents for requirements that directly affect or are affected by Work of this Section. Other Documents and Sections that directly relate to work of this Section include, but are not limited to:
 - 1. General provisions of the Contract, including General and Supplementary Conditions, and Division 01 General Requirements Specification Sections.
 - 2. Section 061053 - MISCELLANEOUS ROUGH CARPENTRY.
 - 3. Division 22 - PLUMBING.
 - 4. Division 26 - ELECTRICAL.

1.2 SYSTEM DESCRIPTION

- A. Performance Requirements:
 - 1. Each accessory with moving parts to utilize 5 pounds or less of force and one hand operation in compliance with ADA Accessibility Guidelines for Buildings and Facilities (ADAAG).
 - a. Provide one-hand operation, with no turning or twisting of wrist required with less than 3 lbs. of force to activate.
 - b. Provide precast shower base with transition and overall interior dimensions complying with ADA requirements.

1.3 SUBMITTALS

- A. Action Submittals:
 - 1. Product Data: Submit manufacturer's printed descriptions of materials and systems, performance criteria, power requirements, wiring diagrams, dimensions, method of attachment, required supports, use limitations, recommendations and installation information and instructions for each manufactured product specified or called out by the Drawings and this Section.
 - 2. Samples:
 - a. Initial for Selection: Submit printed color charts or sample chains indicating manufacturer's complete range to determine color, texture, shape, and/or composition for each type of material finish exposed to view.
 - b. Items Chosen for Final Selection: Submit products for acceptance, those required prior to manufacturing to verify close tolerances, shapes and/or

specifically required aesthetics.

B. Informational Submittals:

1. Quality Assurance Submittals:

- a. Test Reports: Submit certified test results by a recognized testing laboratory in accordance with specified test methods for each product and/or system indicating physical, chemical and performance characteristics.
- b. Certificates: Submit with manufacturer's signature certifying that each product and/or system meets the requirements of the performance characteristics, physical criteria, and applicable standards specified.
- c. Manufacturer's Instructions: Installation.
- d. Qualification Statements: Submit a letter, on printed letterhead and signed by an officer of the firm, for each listed quality assurance qualification listed, attesting to meeting each requirement called out.

1.4 QUALITY ASSURANCE

A. Qualifications:

1. Manufacturer Qualifications: A firm experienced a minimum five (5) years in manufacturing products or systems similar to those indicated for this Project and with a record of successful in-service performance.
2. Installer Qualifications: Perform installation with skilled, experienced and trained workmen supervised by trained personnel who shall have at least three (3) years successful experience in installations of similar size and scope.

B. Source Limitations: Obtain each specified product through one source from a single manufacturer.

C. Pre-installation Meeting: Purpose is to review installation procedures and warranty requirements.

1. Attendees: Architect, Contractor, Manufacturer (to oversee warranty requirements), Installer.
2. Agenda:

1.5 DELIVERY, STORAGE, AND HANDLING

A. Deliver materials and products in unopened factory labeled packages. Store and handle in strict compliance with manufacturer's instructions and recommendations. Protect from damage, moisture and direct sunlight. Sequence deliveries to avoid delays, but minimize on-site storage.

1. Manufacturers, fabricators, suppliers and shippers shall provide least amount of packaging that adequately and properly protects, supports and contains the items shipped, and is reusable, returnable or recyclable.
2. Mark products with Shop Drawing location reference, unless already properly marked.

3. Sequence deliveries to avoid delays, but minimize on-site storage.

1.6 WARRANTY

- A. Contractor shall warrant installation for a period of two (2) years. Upon notification within the warranty period, such defects shall be repaired at no cost to the Owner.
- B. Manufacturer's Warranty:
 1. Defective material warranty for five (5) years.
 2. Manufacturer guarantee against first quality mirrors silver spoilage for 15 years.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Manufacturers include, but are not limited to, the following:
 1. Bobrick Washroom Equipment, Inc.
 2. Sloan.
 3. Koala Kare.
 4. Dyson.

2.2 MATERIALS

- A. Stainless Steel: ASTM A167, Type 304 (18-8); satin finish exposed surfaces unless otherwise specified.
- B. Plastic Laminate: NEMA LD-3.
- C. Die Cast Aluminum (alloyed to silicon and copper): Aluminum Association 380 alloy (UNS A03800).
- D. Hardware:
 1. Locks: Flush rimless pin tumbler locks keyed alike.
 2. Locks: Provide permanent turn knobs.
 3. Magnetic catch.
 4. Concealed heavy-duty 3/16 inch diameter stainless steel piano hinges.
 5. Provide corrosion resistant fasteners and attachment devices, and other fittings necessary to assure function and operation of accessories.
- E. Silver Mirrored Glass: ASTM C1036, Type I, Class 1, quality q2, 1/4 inch thick. Provide silver coating, copper-protective coating, and 1 mil thick mirror backing paint. Comply with CS 27.

2.3 TOILET ACCESSORIES

A. General:

1. Concealed anchor assemblies for gypsum drywall partitions shall be securely anchored to metal studs to accommodate accessories. Assemblies shall consist of plates and/or angles tack welded to studs.
2. Unless otherwise indicated, accessories shall conform to heights from the finished floor as shown on the drawings. Where locations are not indicated, such locations shall be as directed by the Architect.
3. Installed accessories shall operate quietly and smoothly for use intended. Doors and operating hardware shall function without binding or unnecessary friction. Dispenser type accessories shall be keyed alike. Prior to final acceptance, master key and one duplicate key shall be given to Owner's authorized agent.
4. Grab bars shall be installed so that they can support a three hundred (300) lb. load for five minutes per ASTM F 446.

B. Toilet Tissue Dispenser (A-01):

1. Manufacturer/Product: Bobrick B-2888
2. Finish: #4 Stainless Steel

C. Soap Dispenser (A-02):

1. Manufacturer/Product: Bobrick B-4112
2. Finish: #4 Stainless Steel

D. Hand Dryer (A-03):

1. Manufacturer/Product: Dyson Airblade DB
2. Finish: White

E. Mirror (A-04):

1. Manufacturer/Product: Bobrick B-1556 (23-1/2" x 35-1/2")
2. Finish: #4 Stainless Steel

F. Grab Bars (A-05):

1. Manufacturer/Product: Bobrick B-5806 x 18", B-5806 x 36", B-5806 x 42"
2. Finish: #4 Stainless Steel

G. Baby Changing Station (A-06):

1. Manufacturer/Product: Koala Kare KB110-SSWM
2. Finish: #4 Stainless Steel

H. Shower Curtain Rod (A-08):

1. Manufacturer: Bobrick B-207
2. Finish: Satin Finish Stainless Steel

- I. Towel Bar (A-09):
 - 1. Manufacturer: Bobrick B-545
 - 2. Finish: Satin Finish Stainless Steel
- J. Paper Towel Dispenser (A-10):
 - 1. Manufacturer: Bobrick B-4262 Stainless Steel Satin Finish
 - 2. Finish: Satin Finish Stainless Steel

2.4 FINISHES

- A. Stainless Steel: AISI No. 4, satin; AISI No. 8B, bright.
- B. Steel or Aluminum: Neutral toned baked enamel finish.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Carefully examine installation areas with Installer present, for compliance with requirements affecting Work performance.
 - 1. Verification of Conditions: Verify that field measurements, surfaces, substrates, structural support, utility connections, tolerances, levelness, plumbness, humidity, moisture content level, cleanliness and other conditions are as required by the manufacturer, and ready to receive Work.
 - 2. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Substrate Preparation: Prepare substrate in accordance with manufacturer's instructions.
 - 1. Coordinate requirements for adequate blocking support for wall-mounted accessories.
 - 2. Coordinate requirements for power supply, conduit, disconnect switches, and wiring.
- B. Product Handling: Remove shipping / storage protection prior to installation, leaving construction protection in place:

3.3 INSTALLATION

- A. Install in complete accordance with the manufacturer's written instructions and reviewed Shop Drawings.
- B. Interfacing with other Work: For items where the joints are not covered by integral trim, make sure edges are neat. Properly prepare and seal joints with sealant and backer rod per Section 079200 - JOINT SEALANTS, unless noted otherwise in the Drawings.

- C. Warnings: Protect installation from other Work operations.
- D. Installation Tolerances: Toilet accessory installation Work is to be plumb, true, dead level and aligned as indicated on the Drawings and Shop Drawings.
- E. Shower Base: Coordinated with Division 22 - PLUMBING and Section 09300, TILING for installation.

3.4 FIELD QUALITY CONTROL

- A. Inspection: Verify and test that each accessory operates to manufacturer's standards.

3.5 CLEANING AND PROTECTION

- A. At end of each workday, remove rubbish other discarded materials from Project site.
- B. Protect the work of other trades and work of this Section already installed against soiling and damage by the exercise of reasonable care and precautions. Repair or replace any work so damaged or soiled.
- C. At completion of construction activities of other trades, touch up and restore damaged or defaced coated surfaces.

3.6 WASTE MANAGEMENT

- A. Separate and dispose of waste in accordance with the Project's Waste Management Plan.

END OF SECTION

SECTION 104413 - FIRE PROTECTION CABINETS

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Fire-protection cabinets for the following:
 - a. Portable fire extinguishers.

1.2 ACTION SUBMITTALS

- A. Product Data: For each type of product. Show door hardware, cabinet type, trim style, and panel style. Include roughing-in dimensions and details showing recessed-, semi-recessed-, or surface-mounting method and relationships of box and trim to surrounding construction.
 - 1. Show location of knockouts for hose valves.
- B. Shop Drawings: For fire-protection cabinets. Include plans, elevations, sections, details, and attachments to other work.
- C. Samples: For each type of exposed finish required.
- D. Samples: For each type of exposed finish required, prepared on Samples 6 by 6 inches square.
- E. Product Schedule: For fire-protection cabinets. Indicate whether recessed, semi-recessed, or surface mounted. Coordinate final fire-protection cabinet schedule with fire-extinguisher schedule to ensure proper fit and function. Use same designations indicated on Drawings.

1.3 CLOSEOUT SUBMITTALS

- A. Maintenance Data: For fire-protection cabinets to include in maintenance manuals.

1.4 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 PERFORMANCE REQUIREMENTS

- A. Fire-Rated Fire-Protection Cabinets: Listed and labeled to comply with requirements in ASTM E 814 for fire-resistance rating of walls where they are installed.

2.2 FIRE-PROTECTION CABINET

- A. Cabinet Type: Suitable for fire extinguisher.
 - 1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Guardian Fire Equipment, Inc.
 - b. JL Industries, Inc.; a division of the Activar Construction Products Group.
 - c. Larsens Manufacturing Company.
 - d. Modern Metal Products, Division of Technico Inc.
 - e. Nystrom, Inc.
 - f. Potter Roemer LLC.
- B. Basis-of-Design:
 - 1. Fire Extinguisher Cabinet: Guardian 1850 Surface Mounted, 304 Stainless Steel
 - 2. Hose/Valve Cabinet: Guardian 1420 Recessed, 304 Stainless Steel
- C. Cabinet Construction: Nonrated, unless indicated otherwise. Where rated cabinets are required, furnish cabinets rated equally to wall in which they are installed.
 - 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. Cabinet shall be lockable.
- D. Cabinet Material: Cold-rolled steel sheet.
 - 1. Shelf: Same metal and finish as cabinet.
- E. 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.
- F. Surface-Mounted Cabinet: Cabinet box fully exposed and mounted directly on wall with no trim. Provide where walls are of insufficient depth for semirecessed cabinet installation and where indicated on the Drawings.
- G. Cabinet Trim Material: Steel sheet.
- H. Door Material: Steel sheet.

- I. Door Style: Fully glazed panel with frame. Center glass panel with frame.
- J. Door Glazing: Acrylic sheet
 - 1. Acrylic Sheet Color: Clear transparent acrylic sheet.
- K. Door Hardware: Manufacturer's standard door-operating hardware of proper type for cabinet type, trim style, and door material and style indicated.
 - 1. Provide recessed door pull and friction latch.
 - 2. Provide continuous hinge, of same material and finish as trim, permitting door to open 180 degrees.
 - 3. Provide manufacturer's standard lock, with all cabinets keyed alike.
- L. Accessories:
 - 1. Mounting Bracket: Manufacturer's standard steel, designed to secure fire extinguisher to fire-protection cabinet, of sizes required for types and capacities of fire extinguishers indicated, with plated or baked-enamel finish.
 - 2. 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 wall-mounted sign above cabinet.
 - 2). Application Process: Decals.
 - 3). Lettering Color: Red.
 - 4). Orientation: Vertical.
- M. Materials:
 - 1. Cold-Rolled Steel: ASTM A 1008/A 1008M, Commercial Steel (CS), Type B.
 - a. Finish: Baked enamel or powder coat.
 - b. Color: As selected by Architect from full range of industry colors and color densities.
 - 2. Transparent Acrylic Sheet: ASTM D 4802, Category A-1 (cell-cast sheet), 3 mm thick, with Finish 1 (smooth or polished).

2.3 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. Provide factory-drilled mounting holes.
 - 3. Prepare doors and frames to receive locks.
 - 4. Install hardware 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.
- C. Cabinet Trim: Fabricate cabinet trim in one piece with corners mitered, welded, and ground smooth.

2.4 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 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 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.
- 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. Fire-Rated Cabinets:

- a. Seal through penetrations with firestopping sealant as specified in Section 078413 "Penetration Firestopping."

C. Identification: Apply decals at locations indicated.

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

SECTION 108200 - GRILLES AND SCREENS

PART 1 - GENERAL

1.1 SUMMARY

- A. Work of this Section consists of the following:
 - 1. Expanded metal rooftop screen to conceal mechanical equipment.
- B. Related Documents and Sections: Examine Contract Documents for requirements that directly affect or are affected by Work of this Section. A list of those Documents and Sections includes, but is not limited to, the following:
 - 1. Drawings and general provisions of the Contract, including General and Supplementary Conditions, and Division 01 General Requirements Specification Sections.
 - 2. Section 054000 - COLD FORMED METAL FRAMING.

1.2 SUBMITTALS

- A. Product Data: Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for each type of product indicated.
- B. Shop Drawings: Submit shop drawings for fabrication and erection of screen units and accessories. Include plans, elevations and details of sections and connections to adjoining work. Indicate materials, finishes, fasteners, joinery and other information to determine compliance with specified requirements.
- C. Samples:
 - 1. Finishes for selection by Architect.
 - 2. 3 foot sample with specified finish and perforation pattern, as applicable.

1.3 QUALITY ASSURANCE

- A. Installer Qualifications: Capable of assuming engineering responsibility and performing work of this Section and who is acceptable to manufacturer.
 - 1. Engineering Responsibility: Design structural support framing components under direct supervision of professional structural engineer. Engineer shall be licensed by AHJ in the State of Connecticut.
 - 2. Design system to meet indicated wind load requirements
- B. Preinstallation Conference: To review mockup and review work prior to installation.
- C. Comply with SMACNA "Architectural Sheet Metal Manual" recommendations for fabrication, construction details and installation procedures, except as otherwise

indicated.

- D. Field Measurements: Verify size, location and placement of screen units prior to fabrication, wherever possible.
- E. Mock Ups:
 - 1. Prior to installing rooftop screen, construct mockups to verify selections made under Sample submittals and to demonstrate aesthetic effects as well as qualities of materials and execution.
 - 2. Building mock ups to comply with the following requirements, using materials indicated for the Work.
 - a. Provide 24" long, fully finished typical two-panel connection at joint, base connection, edges and corner. Architect will identify scope and location if not otherwise noted on the drawings.
 - b. Notify Architect 7 days in advance of the dates and times when mockups will be constructed.
 - c. Demonstrate the proposed range of aesthetic effects and workmanship, including full panel assembly and attachment, installation of construction adhesive at fasteners.
 - d. Any welding exposed to view to be mocked-up for approval and if accepted, may become part of the project.
 - e. Obtain approval of mockups before start of Work.
- F. Shop Assembly: Coordinate field measurements and shop drawings with fabrication and shop assembly to minimize field adjustments, mechanical attachment and field assembly of units. Pre assemble units in ship to greatest extent possible and disassemble as necessary for shipping and handling limitations. Clearly mark units for re assembly and coordinated installation.

PART 2 - PRODUCTS

2.1 EXPANDED METAL PANEL SCREEN (MTL-04)

- A. Manufacturers:
 - 1. Basis of Design: AMICO
 - 2. McNichols
 - 3. Fratelli.
 - 4. Mariani Metals.
- B. Expanded Metal: Flattened, expanded plain steel, size and pattern as indicated.
- C. Expanded metal shall be welded into U-shaped channel to form rigid panels as indicated on the Drawings.
- D. Panel Margins: As indicated on the Drawings.
- E. Fasteners: As indicated on the Drawings.

F. Exposed Coil-Coated Finish System:

1. Fluoropolymer Three-Coat System: 0.8 mil primer with 0.8 mil 70 percent PVDF fluoropolymer color coat, and a 0.8 mil 70 percent PVDF fluoropolymer clear coat, AAMA 620.
2. Color: As selected by the Architect.

2.2 MATERIALS

- A. Fastenings: Fasteners shall be stainless steel. Provide types, gauges and lengths to suit unit installation conditions.
- B. Anchors and Inserts: Use stainless anchors and inserts for installation and elsewhere as required for corrosion resistance. Use stainless steel or lead expansion bolt devices for drilled-in place anchors. Furnish inserts, as required, to be set into concrete or masonry work.

2.3 MISCELLANEOUS MATERIALS

- A. Miscellaneous Metal Subframing and Furring: ASTM C 645, cold-formed, metallic-coated steel sheet, ASTM A 653/A 653M, G90 (Z275 hot-dip galvanized) coating designation or ASTM A 792/A 792M, Class AZ50 (Class AZM150) aluminum-zinc-alloy coating designation unless otherwise indicated. Provide manufacturer's standard sections as required for support and alignment of metal panel system.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Carefully examine areas with Installer present, for compliance with requirements affecting Work performance.
 1. Verification of Conditions: Verify that field measurements, surfaces, substrates, structural support, utility connections, tolerances, levelness, plumbness, humidity, moisture content level, cleanliness and other conditions are as required by the manufacturer, and ready to receive Work.
 2. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Prior to fabrication, field verify required dimensions.

3.3 INSTALLATION

- A. Install architectural grilles in accordance with manufacturer's installation instructions and approved shop drawings.
- B. Insulate dissimilar metals to prevent electrolysis with bituminous paint or non-absorptive

gasket to prevent contact.

- C. Allow for thermal expansion and contraction of metal components.
- D. Install members plumb, level, free from distortion, and aligned with building elements and adjacent shade panels.
- E. Do not installed bent, bowed, or otherwise damaged panels. Remove damaged components from site and replace.
- F. After installation, touch-up damaged finish with paint supplied by manufacturer and matching original coating.

3.4 WASTE MANAGEMENT

- A. Separate and dispose of waste in accordance with the Project's Waste Management Plan.

END OF SECTION

SECTION 119900 - BULLET RESISTANT ASSEMBLIES

PART 1 - GENERAL

1.1 SUMMARY

A. This Section specifies:

1. Forced entry/bullet resistant fixed aluminum transaction window assemblies.
2. Bullet resistant interior sheathing
3. Bullet resistant hollow metal doors and frames.

B. Related Documents and Sections: Examine Contract Documents for requirements that directly affect or are affected by Work of this Section. A list of those Documents and Sections includes, but is not limited to, the following:

1. Drawings and general provisions of the Contract, including General and Supplementary Conditions, and Division 01 General Requirements Specification Sections.
2. Section 042000 – UNIT MASONRY.
3. Section 087100 - FINISH HARDWARE.
4. Section 088000 – GLAZING.
5. Section 092900 - GYPSUM BOARD.
6. Section 099100 – PAINTING.
7. Section 084000 - ALUMINUM FRAMED FACADE SYSTEMS
8. Section 061053 - MISCELLANEOUS ROUGH CARPENTRY

1.2 SUBMITTALS

A. Product Data: Manufacturer's data sheets on each product to be used, including:

1. Preparation instructions and recommendations.
2. Storage and handling requirements and recommendations.
3. Installation methods.

B. Shop Drawings:

1. Submit shop drawings prepared by the manufacturer showing plans, sections, elevations, layouts, profiles and product component locations, including anchorage, bracing, fasteners, accessories and finishes.
2. Include dimensioned elevation of each type opening assembly in project; indicate sizes and locations of hardware, and lites if specified.
3. Schedule: Indicate each opening assembly in project; cross-referenced to plans, elevations, and details.

- C. Verification Samples: For each finish product specified, two samples, minimum size 6 inches square, representing actual product, color, and patterns.
- D. Test Reports: Certified test reports showing compliance with specified performance
Closeout Submittals:
 - 1. Bullet resistant sheathing and wallboard.
 - 2. Doors.
 - 3. Windows.
- E. Maintenance Data: Include instructions for cleaning of glazed panels.

1.3 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Company specializing in manufacturing products of the type specified with a minimum documented experience of five years.
- B. Coordination of Work: Coordinate layout and installation of components with other construction.

1.4 DELIVERY, STORAGE, AND HANDLING

- A. Deliver materials in manufacturer's unopened, undamaged packaging, with manufacturer's labels intact.
- B. Remove wraps or covers from windows and frames upon delivery at the building site; clean and touch-up scratches or disfigurement caused by shipping or handling promptly.
- C. Store assemblies covered to protect them from damage but permitting air circulation.

1.5 SEQUENCING

- A. Ensure that locating templates and other information required for installation of products of this section are furnished to affected trades in time to prevent interruption of construction progress.
- B. Ensure that products of this section are supplied to affected trades in time to prevent interruption of construction progress.

1.6 PROJECT CONDITIONS

- A. Maintain environmental conditions (temperature, humidity, and ventilation) within limits recommended by manufacturer for optimum results. Do not install products under environmental conditions outside manufacturer's absolute limits.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Basis of Design is based on products by ARMORTEX, Schertz, Texas. Other available manufactures that may be incorporated into the work, but are not limited to, the following:
 - 1. Ceco Door Products, an ASSA ABLOY Group Company, Milan, TN.
 - 2. Total Security Solutions, Inc, Fowlerville, MI.
 - 3. Action Bullet Resistant, Inc., West Islip, NY.
 - 4. Republic Door & Frame, McKenzie, TN.
 - 5. Approved Equal

2.2 MATERIAL

- A. Extruded Aluminum: ASTM B 221; 6061 alloy, T5 temper typical, 6061 alloy, T6 temper for extruded structural members.
- B. Sheet Aluminum: ASTM B 209, 5005 alloy, H15 or H34 temper.
- C. Sheet Steel: ASTM A1008/1008M, cold rolled, free from scale, pitting, coil breaks, and other surface defects.
- D. Steel Sections: ASTM A 36/A3 6M; shaped to suit mullion sections, galvanized.
- E. Internal framing fasteners Type 18-8 stainless steel.
- F. Neoprene glazing gaskets:
 - 1. Interior Glazing gaskets closed cell cellular neoprene conforming to ASTM C 509 Type II Option 1 with a 40-50 Shore A Durometer.
 - 2. Exterior Glazing gaskets solid neoprene conforming to ASTM C 864 with a 65-75 Shore A Durometer.
- G. Weatherstripping: Entrance manufacturer's standard types to suit application.
- H. Fasteners: Stainless steel or corrosion resistant steel.

2.3 FIXED TRANSACTION WINDOWS

- A. Aluminum Thermally Broken Transaction Window:
- B. Manufacturers: Subject to compliance with requirements, provide windows equal to Creative Industries Walk up Window
 - 1. Frames: Aluminum. Overall frame size to be 48"H x 90"W - 3 lites; 3 drawers in continuous unit.
 - 2. Finish: All aluminum to be clear anodized.
 - 3. Glazing: Level 3 bullet resistant, coordinate thickness with manufacturer.

4. Voice transmission: Communication permitted by Creative Industries No. 5-D Talk Thru, positioned in glazing per Drawings.
5. Fabrication:
 - a. Fabricate frames from aluminum extrusions with continuous structural urethane thermal barrier around perimeter so that frame is not bridged by metal conductors at any point. Thermally improved frames not acceptable.
 - b. Fabricate frames with 2-1/2 inches face width, 6 inches overall depth, and glazing cavity dimensions of 1.75 inches deep x 2.875 inches wide.
 - c. Fabricate frames without exposed fasteners.
 - d. Furnish embeds and anchors as required by engineering analysis and calculations.
 - e. Welding: In accordance with AWS D1.2/D1.2M. Grind exposed welds flush and smooth.
 - f. Finish work neat and free from defects.
 - g. Allowable Tolerances: Plus or minus 1/16 inch for frame opening width, height, diagonal dimensions, and overall width and height (outside to outside).
6. Finish: Anodized finish as specified herein.

2.4 BULLET RESISTANT DOORS

A. Bullet Resistant Hollow Metal Door and Frame

1. Design Requirements: Provide door and frame assemblies of "non-ricochet type" intended to permit capture and retention of attacking projectile, lessening potential of random injury or lateral penetration.
 - a. Ballistic Level: 1, tested to UL 752.
2. Material:
 - a. Steel Sheet: ASTM A1008/1008M, cold rolled, free from scale, pitting, coil breaks, and other surface defects.
 - b. Bullet resistant Composite: UL Listed Bullet Resistant Composite of UL level equal to specified door and frame ballistic protection level.
3. Door Fabrication:
 - a. Fabricate with 16 gage steel face plates, foam insulation, and bullet resistant composite core.
 - b. Weld 16 gage rails and stiles to face plates with flush surface on all edges.
 - c. Factory hang doors in frames using specified hinges.
 - d. Mortise and reinforce doors and frames at factory to receive hardware in accordance with approved hardware schedule.
4. Frame Fabrication:
 - a. Same ballistic protection as doors.
 - b. Fabricate from 16 gage steel lined with bullet resistant composite.
 - c. Weld frame corners; knock-down and mechanical joints not acceptable.
5. Construction/Finish:
 - a. Welding: In accordance with AWS D1.3/D1.3M. Grind exposed welds flush and

smooth.

- b. Finish work neat and free from defects.
- c. Allowable Tolerances: Plus or minus 1/16 inch for frame opening width, height, diagonal dimensions, and overall width and height (outside to outside).
- d. Dress tool marks and surface imperfections to smooth surfaces.
- e. Clean and chemically treat steel surfaces.
- f. Apply manufacturer's standard rust inhibiting gray primer paint.

2.5 BULLET RESISTANT SHEATHING

A. Performance Criteria

1. Bullet Resistant Fiberglass Panels shall be "non ricochet type" to permit the encapture and retention of an attacking projectile lessening the potential of a random injury or lateral penetration.
2. Panel Rating: UL752 Level 2.
3. Bullet resistance of joints: equal to that of the panel.

B. Materials

1. Panels fabricated of multiple layers of woven roving ballistic grade fiberglass cloth impregnated with a thermoset polyester resin and compressed into flat rigid sheets.
2. Thickness: 5/16" nominal thickness
3. Nominal Weight: 3.6 lbs. per sq. ft.
4. Panels shall be manufactured in the United States of America with raw materials sourced from the USA for quality assurance purposes.

2.6 STEEL FINISHES

- A. Dress tool marks and surface imperfections to smooth surfaces.
- B. Clean and chemically treat steel surfaces.
- C. Apply manufacturer's standard rust inhibiting gray primer paint.

2.7 ALUMINUM FINISHES

- A. Anodized Finishing: Prepare aluminum surfaces for specified finish; apply shop finish in accordance with the following:
 1. Anodic Coating: Electrolytic color coating followed by an organic seal applied in accordance with the requirements of AAMA 612. Aluminum extrusions shall be produced from quality controlled billets meeting AA-6063-T5.
 - a. Exposed Surfaces shall be free of scratches and other serious blemishes.
 - b. Extrusions shall be given a caustic etch followed by an anodic oxide treatment and then sealed with an organic coating applied with an electrodeposition process.

- c. The anodized coating shall comply with all of the requirements of AAMA 612: Voluntary Specifications, Performance Requirements and Test Procedures for Combined Coatings of Anodic Oxide and Transparent Organic Coatings on Architectural Aluminum. Testing shall demonstrate the ability of the finish to resist damage from mortar, salt spray, and chemicals commonly found on construction sites, and to resist the loss of color and gloss.
 - d. Overall coating thickness for finishes shall be a minimum of 0.7 mils.
 - 1). CASS Corrosion Resistance Test, CASS 240/ASTM B368 Test Method.
 - 2). Other AAMA 2605 Performance Tests specified in these specifications, such as: 7.3 Dry Film Hardness; 7.8.2 Salt Spray Resistance; 7.9.1.2 Color Retention, South Florida; 7.9.1.4 Gloss Retention, South Florida.
- B. Finishes Testing:
- 1. Apply 0.5% solution NaOH, sodium hydroxide, to small area of finished sample area; leave in place for sixty minutes; lightly wipe off NaOH; Do not clean area further.
 - 2. Submit samples with test area noted on each sample.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Do not begin installation until substrates have been properly prepared.
- B. If substrate preparation is the responsibility of another installer, notify Architect of unsatisfactory preparation before proceeding.

3.2 PREPARATION

- A. Clean surfaces thoroughly prior to installation.
- B. Prepare surfaces using the methods recommended by the manufacturer for achieving the best result for the substrate under the project conditions.

3.3 DOOR AND WINDOW INSTALLATION

- A. Install in accordance with manufacturer's instructions. Install plumb, level, square, true to line, and without warp or rack. Provide all fasteners required for installation.
- B. Anchor frames securely in place to supports. Use attachment methods permitting adjustment for construction tolerances, irregularities, alignment, and expansion and contraction.
- C. Separate aluminum from other metal surfaces with bituminous coatings or other means approved by Architect.
- D. Sheet Metal Flashing: Coordinate with sheet metal flashing as specified in Section 07620.
- E. Adjust door equipment for correct function and smooth operation. Verify water and

weather tight installation as applicable.

3.4 SHEATHING INSTALLATION

- A. Install armor in accordance with manufacturer's printed recommendations and as required by contract documents.
- B. Secure armor panels using screws, bolts, or an industrial adhesive.
- C. Method of application shall install panels minimizing vulnerabilities by fitting tightly to adjacent surfaces including concrete floor slab, concrete roof slab, bullet resistive door frames, bullet resistive window frames, and the like.

3.5 FIELD QUALITY CONTROL

- A. Manufacturer's representative to verify that installation is in conformance to the manufacturer's recommendations.

3.6 CLEANING

- A. Clean interior and exterior glass surfaces promptly after installation in accordance with manufacturer's instructions.
- B. Remove excess joint sealant in accordance with sealant manufacturer's instructions.
- C. Do not use harsh cleaning materials or methods that would damage glazing or finish.

3.7 PROTECTION

- A. Protect installed products until completion of project.
- B. Touch-up, repair or replace damaged products before Substantial Completion.

END OF SECTION

SECTION 142400 - HYDRAULIC ELEVATOR

PART 1 - GENERAL

1.1 SUMMARY

- A. These specifications are intended to cover the complete installation of one (1) twin jack holeless hydraulic passenger elevator at the North Waterfront Park in Wilmington, North Carolina.

1.2 RELATED WORK

- A. A mainline fused disconnect switch shall be provided for the elevator. The mainline disconnect switch shall be located approximately 18" from the strike side of the machine room door and 52" above the floor. Provide an auxiliary contact for battery lowering device.
- B. 110 Volt circuit breaker panel with lockout capabilities.
- C. Machine room lighting with the light switch located directly adjacent to the strike jamb and two (2) 20 AMP G.F.I. outlets.
- D. A phone line circuit in the machine room for emergency communications (24 hour emergency communications to an accessible location must be provided.).
- E. Adequate mechanical ventilation of machine room and/or machinery space to maintain temperature between 55°F and 90°F. and not to exceed 85% relative humidity.
- F. Provisions for natural ventilation directly to the outside air.
- G. A weather resistant type lighting fixture and G.F.I. outlet in the elevator pit. (The bulb must be protected by a grounded metal guard or lexan cover.) The switch shall be located adjacent to the strike side of the pit access door. Final locations of light, outlet and switch to be field coordinated in accordance with the elevator layout drawings.
- H. Smoke detectors as required in the elevator lobbies, machine room and hoistway including wiring and activation signals brought to the elevator machine room terminating in a junction box located adjacent to the elevator controller.
- I. Enclosed and protected machine room and/or machinery space. Minimum machine room height shall be 8' - 0".
- J. Access to machine room and/or machinery space to be a minimum of 3' – 6" wide by 6' – 8" high and shall be self-closing and locking. The lock shall be non-canceling and operate from within the room without the use of a key.
- K. Clear hoistway plumb from top to bottom with variations not to exceed one 1" at any point in the first 100 feet. Tolerance may increase at 1/32" for each additional ten (10) feet up to a maximum displacement of 2".

- L. Beveled guards are required for projections, recesses and setbacks in the hoistway that project more than 2" inside the general line of the hoistway on sides not used for loading or unloading.
- M. Hoistway protection in case of fire. (Two (2) hour rated enclosure or as required by local building codes.)
- N. Supports for guide rail fastenings at each floor and/or intermediate supports. Provisions for bracket spacing should not exceed 10' - 0".
- O. Recesses, fireproofing and patching, as required, to accommodate hall button boxes, signal fixtures, hoistway entrance frames, etc.
- P. Vertical, noncombustible ladder for the elevator extending 42" above the sill of the access door where the pit extends more than 36" below the sill of the access door.
- Q. Dry pit including sump pit, pump or drains. Drains connected directly to sewers shall not be installed. Provide covers over sump pits or drains. Provide pump with oil minder switch and associated accessories.
- R. Pit reinforced to sustain vertical forces from guide rails, buffers and cylinders.
- S. Entrance walls for elevator are not to be constructed until door frames and sills are in place.
- T. Furnishing, installing and maintaining the required fire rating of elevator hoistway walls, including the penetration of fire wall by elevator fixture boxes.
- U. The interface of the elevator wall with the hoistway entrance assembly shall be in strict compliance with the elevator supplier's/contractors supplier's requirements.
- V. Door frames are to be anchored to walls and properly grouted in place if installed in masonry walls to maintain fire ratings. The head jamb of the entrance frames shall not be used to support the weight of the wall over the frame.
- W. Support for sills the full width of hoistway, with 2 ½" minimum recesses including grouting after sills are set in place.
- X. Provide sill support angles.
- Y. Refer to the Drawings for additional related work items.
- Z. Refer to all Contract Documents for additional construction details. All Related Work must be coordinated by the Elevator Contractor.

1.3 QUALITY ASSURANCE

- A. The Elevator Contractor shall be an established firm of at least five (5) years in existence and have installed a minimum of five (5) elevators of similar size and application to this project. Submit proof of compliance of this requirement with the bid proposal.
- B. The approved hydraulic elevator companies and component manufacturers are:

1. Canton
2. Minnesota Elevator Company
3. Mongrain
4. ThyssenKrupp Elevator

C. Additional approved equipment manufacturers:

1. Controller - MCE, G.A.L., ESI
2. Fixtures - EPCO, G.A.L., Monitor, National
3. Door Protective Device – G.A.L., Janus, Tri-Tronics
4. Cabs and Entrances – CEC, EDI/ECI, National Cab & Door
5. Approved Equal

1.4 STANDARDS

- A. Except as modified by governing Codes and by this Division, the work shall comply with provisions of the latest editions of the following, and in the event of conflict between these standards, the Architect's/Consultant's determination shall be final:
- B. ASME A17.1: The American Society of Mechanical Engineers - Safety Code for Elevators and Escalators including Supplements as adopted by the local jurisdiction.
- C. ANSI A117.1: American National Standards for Buildings and Facilities Providing Accessibility and Usability for Physically Handicapped People.
- D. International Building code (Applicable Edition).
- E. ADA: Americans with Disabilities Act.

1.5 SUBMISSION, SAMPLES, CUTS AND DRAWINGS

- A. The Shop Drawings shall show material type and gauge, general dimensions, methods of attachment, location and size of reinforcements and openings, and a general arrangement of components. Approval thereof shall not relieve the Contractor of compliance with the specification. Shop drawings shall be reflective of all Contract Documents. The Drawings submitted shall be as follows:
 1. Elevator section showing overhead, pit and floor to floor dimensions. The drawing shall be scaled and shall show all structure and beam locations and details. Details shall include the height of the cab, door operator and crosshead, including details of rope shackle.
 2. Hoistway plan shall clearly show all typical dimensions to scale. In addition, plan shall identify all structural beam and divider beam locations and sizes; widths and depth of beams as they relate to the clear hoistway and hoistway walls; column pads in the pit and all column intrusions into the shaft. Provide large scale drawings and details of sill support condition and column encroachments.
 3. Provide machine room plan showing all typical dimensions and equipment layout. Show clearly all electrical disconnects or switchgear in the code compliant location and to scale.

4. Provide large scale drawings for the car enclosure showing cab plan, reflective ceiling, wall elevations, front returns and car station integration. Detail section through wall panel from canopy to platform. Detail section through suspended ceiling including attachment to canopy. Detail typical joints, reveals and panel edging, panel attachments, handrail fastening and pad button attachment to shell. Include all gauges of steel components. Provide thickness and type of materials used for wall panels and ceiling along with lamination details.
 5. Entrance details with the same specifics and quality of information provided for the cab details.
 6. Provide fixture drawings job specific in large scale. Identify all engraving including font, depth of engravings and infill color material. (No applied or recessed plates shall be acceptable except for Braille plates.) Provide gauges of all material used. Provide faceplate fastener and hinging method and type.
 7. Provide cut section through emergency light, position indicator, auto-dial telephone, buttons, Braille plates and service cabinet. (If requested)
 8. Car frame and car platform construction details and layout complete. (If requested)
 9. Machine isolation foundation fastening details and hydraulic oil line isolation fastening details (as applicable). Include manufacturer's data of all isolation equipment used.
- B. Sample submissions shall include:
1. Cab or fixture material and finishes.
 2. Braille plates and jamb designation.
 3. Push-buttons, position indicators, emergency lighting fixture.
- C. Sixty (60) days prior to the completion of the work of the contract, the Contractor shall submit to the Construction Manager six (6) copies of an Operation Maintenance and Parts Manual and six (6) complete sets of as-builts.

1.6 TERMS / DEFINITIONS

- A. All terms in the specifications shall be as defined in ASME A17.1.
- B. "Consultant" shall mean the firm of IROS Elevator Design Services, LLC.
- C. "Contractor" shall mean the person, firm or corporation named in the Contract Documents who will execute the Work. It shall include all his employees, subcontractors and suppliers.
- D. "Provide" shall mean to supply, install and connect up complete and ready for safe and regular operation the particular work referred to.
- E. "Install" shall mean to erect, mount and connect complete with related accessories.
- F. "Furnish" or "Supply" shall mean to purchase, procure, acquire and deliver complete with related accessories.
- G. "Work" shall mean the services, materials, labor and all other equipment required for complete and proper installation by the Contractor.

- H. "Best", "first-class" or similar terms as applied to materials, products and workmanship shall mean that, in the Architect's opinion, there are no superior qualities of materials or products on the market, and there is no better class of workmanship.
- I. "Concealed" shall mean in masonry or other construction, installed in furred spaces, within double partitions or hung ceilings, in trenches, in crawl spaces or in enclosures.
- J. "Exposed" shall mean not installed underground or "concealed" as defined above.

1.7 PERMITS

- A. The Contractor shall file all necessary plans and application with the local building department or other authorities having jurisdiction and obtain the required permits and approvals.
- B. The Contractor shall submit to the Construction Manager/General Contractor a copy of the permit application, elevator specs, permit and print of elevator drawings as submitted and approved by the authority having jurisdiction.
- C. Upon completion of the work, and prior to final payments, tests may be made by the Owner of all materials and appliances installed hereunder. The Contractor shall furnish all labor and materials required for such tests.
 - 1. Should the tests show that any of the materials, appliances or workmanship are not first class or not in compliance with the Specifications, the Contractor shall remove same and promptly replace them with other materials and appliances in conformity with the Specifications.
- D. The Contractor shall perform all tests required by the authorities having jurisdiction in the presence of an authorized inspector to obtain Final Certificate of Inspection prior to turnover of the elevator.

1.8 PROTECTION

- A. Protect all items against dirt and damage. The Contractor shall be held fully responsible for all damage until final acceptance. Any equipment or property damaged by this Contractor or his employee's, shall be restored to its original condition or replaced without cost to the Owner.

1.9 WARRANTY

- A. The elevator contractor shall guarantee the materials and workmanship of the apparatus furnished under these specifications and shall make good any defects which may develop within one (1) year from the date of final acceptance of the elevator.

1.10 MAINTENANCE

- A. Furnish full protective maintenance on the equipment described herein for a period of one (1) year from the date of final acceptance of the entire installation. The maintenance shall include systematic monthly examinations, adjustments and lubrication of all equipment.

Also repair or replace any parts of equipment whenever this is required during the maintenance period and shall use only genuine standard parts produced by the manufacturer of the equipment installed.

- B. All work under the maintenance provisions shall be performed by competent personnel under the supervision and in the direct employ of the Contractor and 24-hour emergency call back service shall be available at all times and be included in the cost of the contract. Maximum response time for an entrapment shall not exceed 30 minutes and shall not exceed 2 hours for non-emergency shutdowns.
- C. Full protective maintenance requirements:
 - 1. Regularly and systematically examine, adjust, lubricate, clean and when conditions warrant repair or replace the following items and all other mechanical or electrical equipment.
 - 2. Hydraulic power unit and accessories: pump, motor, valves, operating valves, pulleys, drive belts, flexible hydraulic hose and fitting assemblies, oil tank, muffler, strainer, sound isolating coupling, plunger, packing gland, scavenger system, piping and other components.
 - 3. Controller, Selector and Dispatching Equipment: all components including all relays, solid state components, resistors, condensers, transformers, contacts, leads, dashpots, computer devices, selector switches, mechanical or electrical driving equipment, coils, magnet frames, contact switch assemblies, springs, solenoids, resistance grids, hoistway vanes, magnets and inductors.
 - 4. Hoistway door interlocks or locks and contacts, hoistway door hangers and tracks, bottom door gibs, cams, rollers, and auxiliary door closing devices for power operated doors. Chains, tracks, cams, interlocks, sheaves for vertical bi-folding doors.
 - 5. Hoistway limit switches, slowdown switches, leveling switches and associated cams, vanes, and electronic components.
 - 6. Guide shoes including rollers or replaceable gibs.
 - 7. Automatic power operated door operators, door protective devices, car door hangers, tracks and car door contacts for both side slide and vertical bi-folding doors.
 - 8. Traveling cables.
 - 9. Elevator control wiring in hoistway and machine room.
 - 10. Car safety mechanism and load weighing equipment.
 - 11. Buffers.
 - 12. Fixture contacts, push-buttons, key switches, locks, lamps and sockets of button stations (car and corridor), corridor lanterns, position indicators (car and corridor), direction indicators.
 - 13. The guide rails shall be kept free of rust. Where roller guides are used, rails shall be kept dry and properly lubricated when sliding guides are used. Renew guide shoe rollers and gibs as required to insure smooth and satisfactory operation.
 - 14. Examine, and make necessary adjustments or repair to the following accessory equipment including relamping of signal equipment: corridor lanterns, car and corridor position indicators, car stations, traffic director station, electric door operators, interlocks, door hangers, safety edge, and auto-dial telephone systems.
 - 15. Examine regularly and systematically all safety devices, and conduct an annual no

- load test, and each third year perform a full load, full speed test of safety mechanism and car buffers. The car balance shall be checked. All tests shall be performed in accordance with the provisions of the American National Standard, Safety Code for Elevators and Escalators (ANSI/ASME A17.1), current edition. Repair or replace conductor cables and hoistway and machine room elevator wiring.
16. Maintain all elevator equipment in hoistways, machine rooms, and pits in a clean, orderly condition, free of dirt, dust and debris.
 17. Furnish lubricants compounded specifically for elevator usage.
 18. Contractor shall not be required to make renewals or repairs necessitated by reason of negligence or misuse of the equipment or by reason of any other cause beyond the contractor's control except ordinary wear and tear unless the Contractor receives just compensation.
 19. The Elevator Subcontractor shall not be responsible for the following items of elevator equipment: cab interior (including removable panels, door panels, car gates, plenum chambers, hung ceilings, light diffusers, light tubes and bulbs, handrails, mirrors and carpets): hoistway enclosure, hoistway door, frames and sills.
 20. Emergency calls and minor repairs shall be answered at all hours of the day or night. Minor repairs shall mean those repairs which can be remedied by replacing a spare component stored on-site as further specified. Major repairs and normal preventative maintenance work shall be performed during normal business hours. Should overtime work be required for repairs other than minor repair work, the Owner will pay the actual amount of the premium portion of the wage. The Contractor shall pay the basic hourly rate.
 21. The Contractor shall check the group dispatching systems (if applicable) and make necessary tests to insure that all circuits and time settings are properly adjusted, and that the system performs as designed and installed.
 22. Contractor shall perform the required mandated inspections and tests as required per local jurisdictions during the term of the included one (1) year maintenance contract.
- D. The Contractor shall keep the elevator maintained to operate at the original contract speed, keeping the original performance time, including acceleration and retardation as designed and installed by the manufacturer. The door operation shall be adjusted as required to maintain the original door opening and door closing times, within legal limits.
- E. The Owner reserves the right to make inspections and tests as and when deemed advisable. If it is found that the elevator and associated equipment are deficient either electrically or mechanically, the Contractor will be notified of these deficiencies in writing, and it shall be his responsibility to make the necessary corrections within 30 days after his receipt of such notice. In the event that the deficiencies have not been corrected within 30 days, the Owner may terminate the Contract and employ a Contractor to make the corrections at the original bidder's expense.
- F. Approximately six months prior to the end of the contract term, the Owner may make a thorough maintenance inspection of the elevator covered under the contract. At the conclusion of this inspection, Owner may give the Contractor written notice of any deficiencies found. The Contractor shall be responsible for correction of these deficiencies within 30 days after receipt of such notice.
- G. The Owner reserves the right to accept or reject any or all alternates.

1.11 KEYS

- A. At the completion of all work, the Contractor shall furnish ten (10) sets of keys for each key device installed.

1.12 ASSIGNMENTS

- A. The Elevator Contractor is not assignable as a whole or in part without the written consent of the Owner.

1.13 FEES AND TAXES

- A. The base bid price shall include all permits, materials and equipment to be furnished on the site. In addition, the Contractor shall include all local, state and federal occupational and sales taxes, luxury taxes, excise taxes, federal and state old-age pensions and unemployment insurance contributions and any other similar taxes, fees and contributions in effect at the time of the signing of the contract. The Elevator Contractor is liable for the above mentioned taxes whether or not specifically mentioned in his bid or in the final contract document.

PART 2 - PRODUCTS

2.1 DESCRIPTION OF ELEVATOR SYSTEM

A. ELEVATOR:

1. Quantity	One (1) Twin Jack Holeless Hydraulic Passenger Elevator
2. Capacity	2,500 Pounds
3. Speed	100 FPM
4. Travel	15' - 0"
5. Number of Landings	Three (3) 1st, VIP, 2nd Floors
6. Number of Openings	Same as Landings (2-Front & 1-Rear)
7. Operation	Simplex Selective Collective
8. Control	Microprocessor
9. Clear Cab	6' - 8" Wide x 4' - 3" Deep
10. Buffers	Spring
11. Car Enclosure	As Further Specified
12. Landing Doors	3' - 6" Wide x 7' - 0" High
13. Door Operation	Single Speed Side Opening
14. Machine Location	Remote (within 10' of hoistway)
15. Communication Equipment	Auto-Dial Telephone (Car and Machine Room)
16. Power Supply	3 Phase Building Voltage. Provide an Auxiliary Contact (Verify Voltage)

2.2 POWER UNIT (SUBMERSIBLE TYPE)

- A. The power unit shall be compactly and neatly designed with all components combined in a self-contained unit and with all adjustment features accessible. It shall include (at a minimum) a constant displacement rotary screw-type, pump motor designed for oil hydraulic elevator service, oil reservoir (minimum 10-gallon reserve) with an oil-level indicator, control valve, tank strainer in the suction line, integral pressure gauge and blowout proof muffler to reduce pulsations that may occur in the system. The power unit shall be tested and adjusted at the factory by operating a test elevator loaded to conform to the elevator specified herein.
- B. The motor shall be designed for 120 starts per hour.

2.3 POWER UNIT ISOLATION

- A. The power unit shall be mounted on vibration sound dampeners designed to isolate the unit from the building structure. Sound and vibration isolation pads shall be installed between the motor/pump assembly and the power unit structure and between the power unit and the machine room floor.
 - 1. Provide neoprene vibration isolator pads.
 - 2. All wiring connections to the power unit shall be flexible conduit, minimum 36" long, and installed slack.

2.4 VALVES

- A. A control valve including safety check valve, up direction valve with high pressure relief including up leveling and soft stop features, lowering valve including down leveling and manual leveling feature shall be mounted in a compact unit assembly. Control valves shall be solenoid operated and designed to open and close gradually to give smooth control. All valves shall be readily accessible for adjustment. The valve shall be equipped with a "no pressure sensing device" which will disable the piston from dropping if the car is blocked for any reason.

2.5 AUTOMATIC TWO-WAY LEVELING

- A. An automatic two-way leveling device shall be provided so that the car will approach landing stops at reduced speed from either direction of travel. The leveling device shall, within its zone, be entirely independent of the operating device and shall automatically stop and maintain the car within 1/4" level with the landing, regardless of change in load.

2.6 JACK UNIT

- A. Design and construct the jack unit in accordance with the applicable requirements of the ASME Code. It shall be of sufficient size to lift the gross load at the rated speed to the height specified and shall be factory tested to ensure adequate strength and freedom from leakage. No brittle material, such as gray cast iron, shall be used in the jack construction.

- B. The jack unit shall consist of the following parts: a plunger of heavy seamless steel tubing accurately turned and polished; a stop ring electrically welded to the plunger to positively prevent the plunger leaving its cylinder; an internal babbitt-lined guide bearing, packing or seal of suitable design and quality, a drip ring around cylinder top and a cylinder made of steel pipe and provided with a pipe connection and air bleeder.
- C. Install jack unit plumb with heavy duty clamps to attached guide rail brackets and/or building structure and intervals not to exceed 7' - 0" or as recommended by the equipment supplier.

2.7 PACKING GLAND AND OIL RETRIEVAL SYSTEM

- A. A steel packing gland with phenolic guide bearing, wiper ring and packing especially designed for hydraulic elevator service shall be provided. An oil retrieval system shall be furnished to return oil leakage back to the storage tank.

2.8 PIPING

- A. All hydraulic piping outside the power unit shall be seamless Schedule 80 Pipe with threaded connections.

2.9 HYDRAULIC MUFFLER AND ISOLATION COUPLINGS

- A. A muffler shall be provided in the oil line near the power unit. The muffler shall be designed to reduce pulsation and noise which may be present in the flow of the hydraulic fluid.
 - 1. Provide sound isolation couplings in the oil line. The couplings shall incorporate neoprene seals and gaskets to limit the transmission of vibrations.
 - 2. When the hydraulic pipe penetrates a wall or slab, the gap shall be filled with properly sized isolation and sealed accordingly.

2.10 CONTROLLER AND OPERATION

- A. A generic non-proprietary microprocessor-based controller shall be provided including necessary starting switches together with all relays, switches, solid state components and hardware required for operation, including door operation, as described herein. Operational control shall be by microprocessor. A three-phase overload device shall be provided to protect the motor against overloading.
- B. The elevator shall not require the functioning or presence of the microprocessor to operate on car top inspection or hoistway access operation to provide a reliable means of moving the car if the microprocessor fails.
- C. A motor limit timer function shall be provided which, in case of the pump motor being energized longer than a predetermined time, shall cause the car to descend to the lowest landing and park, open the doors automatically and then close them. Car calls shall be canceled and the car taken out of service automatically. Operation may be restored by cycling the main line disconnect switch or putting the car on access or inspection

operation. Door reopening devices shall remain operative.

- D. A valve limit timer shall be provided which shall automatically cut off current to the down valve solenoids if they have been energized longer than a predetermined time. The car calls shall then be canceled and the car taken out of service automatically. Operation may be restored by cycling the main line disconnect switch or putting the car on access or inspection operation. Door reopening devices shall remain operative.
- E. A selector switch shall be provided on the controller to select high or low speed during access or inspection operation as long as contract speed does not exceed 150 feet per minute.
- F. Viscosity control shall cause the car to accomplish the following operation. A temperature sensor shall be provided to determine if the oil is too cold, and if there are no calls registered, the car shall go to the bottom landing and, as long as the doors are closed, the pump motor shall run without the valve coils energized to circulate and heat the oil to the desired temperature. In the event that the temperature sensor fails, a timer shall prevent continuous running of the pump motor.
- G. The control system shall provide comprehensive means of accessing the computer memory for elevator diagnostic purposes. It shall have permanent indicators for important elevator statuses as an integral part of the controller.
- H. Failure of any single magnetically operated switch, contactor, or relay to release in the intended manner; the failure of any static control device, speed measuring circuit, or speed pattern generating circuit to operate as intended; the occurrence of a single accidental ground or short circuit; shall not permit the car to start or run if any hoistway door or gate interlock is unlocked or if any hoistway door or car door or gate contact is not in the made position. Furthermore, while on car top inspection or hoistway access operation, failure of any single magnetically operated switch, contactor or relay to release in the intended manner; the failure of any static control device to operate as intended; or the occurrence of a single accidental ground, shall not permit the car to move even with the hoistway door locks and car door contacts in the closed or made position.
- I. Dedicated permanent status indicators shall be provided on the controller to indicate when the safety string is open, when the door locks are open, when the elevator is operating at high speed, when the elevator is on independent service, when the elevator is on fire service, when the elevator out of service timer has elapsed, and when the elevator has failed to successfully complete its intended movement. In addition, a means shall be provided to display other special or error conditions that are detected by the microprocessor.
- J. An out of service timer shall be provided to take the car out of service if the car is delayed in leaving the landing while there are calls existing in the system.
- K. Door Protection Timers:
 - 1. Door protection timers shall be provided for both the opening and closing directions, which will protect the door motor and will help prevent the car from getting stuck at a landing. The door open protection timer shall cease attempting to open the door after a predetermined time in the event that the doors are prevented from reaching the open position. In the event that the door closing attempt fails to make up the door

- locks after a predetermined time, the door close protection timer shall reopen the doors for a short time. If, after a predetermined number of attempts, the doors cannot successfully be closed, the doors shall be opened and the car removed from service.
2. A minimum of four different door standing open times shall be provided. A car call time value shall predominate when only a car call is canceled. A hall call time value shall predominate whenever a hall call is canceled. In the event of a door reopen caused by the safety edge, photo eye, etc., a separate short door time value shall predominate. A separate door standing open time shall be available for lobby return.
 3. If the doors are prevented from closing for longer than a predetermined time, door nudging operation shall cause the doors to move at slow speed in the closed direction. A buzzer shall sound during the nudging operation.
- L. Car and hall call registration and lamp acknowledgment shall be by means of a single wire per call, in addition to the ground and the power bus. Systems that register the call with one wire and light the call acknowledgment lamp with a separate wire, are not acceptable.
- M. Fire Phase I emergency recall operation and Phase II emergency in-car operation shall be provided according to applicable local codes.
- N. Independent service operation shall be provided in such a way that actuation of a key switch in the car operating panel will cancel any existing car calls, and hold the doors open at the landing. The car will then respond only to car calls. Car and hoistway doors will only close with constant pressure on a car call push-button or the door close button. While on independent service, hall arrival lanterns or jamb mounted arrival lanterns shall be inoperative.
- O. Simplex Selective Collective automatic operation shall be provided for the installations. Operation of one or more car or hall call push-buttons shall cause the car to start and run automatically, provided the hoistway door interlocks and car door contacts are closed. The car shall stop at the first car or hall call set for the direction of travel. Stops shall be made in the order in which car or hall calls set for the direction of travel are reached, regardless of the order in which they were registered. If only hall calls set for the opposite direction of travel of the elevator exist ahead of the car, the car shall proceed to the most distant hall call, reverse directions, and start collecting the calls.
- P. A relay panel inspection switch and an up/down switch shall be provided in the controller to place the elevator on inspection operation and allow the user to move the car in the hoistway. The car top inspection switch shall render the relay panel inspection switch inoperative.
- Q. A timer shall be provided to limit the amount of time a car is held at a floor due to a defective hall call or car call, including stuck push-buttons. Call demand at another floor shall cause the car, after a predetermined time, to ignore the defective call and continue to provide service in the building.
- R. The microprocessor boards shall be equipped with on-board diagnostics for ease of troubleshooting and field programmability of specific control variables. The field changes shall be stored permanently, using non-volatile memory. The microprocessor board shall provide the features below.

1. On-board diagnostic switches and an alphanumeric display. These switches and displays shall provide user-friendly interaction between the mechanic and the controller.
 2. On-board real time clock. The real time clock shall display the time and date and is adjustable by means of on-board switches.
 3. Field programmability of specific timer values (i.e., door times)
- S. As an integral part of the controller, the capability shall be provided to attach on-site or remote computer peripherals, yielding additional adjustment or diagnostic capabilities.
- T. Hoistway Access Key Switch operation at the terminal landings are to gain access to the top of the car from the top landing and to gain access to the pit from the bottom landing.
- U. Provide a keyed floor lockout.

2.11 REDUCED CURRENT STARTING

- A. Reduced current starting shall be furnished which shall limit both the initial starting current and peak current drawn by the motor.
1. Provide solid state reduced voltage starting systems.

2.12 LOW OIL CONTROL

- A. In the event of a low oil condition, a low oil control feature shall be provided designed to automatically cause an up traveling car to descend to the lowest terminal landing to permit passengers to egress. The doors shall then automatically close and all control buttons, except the "Door Open" button in the car operating panel, shall be made ineffective. The oil reservoir should be refilled before the elevator is returned to service. The low oil control may be utilized as part of the Automatic Lowering Feature as specified herein.

2.13 AUTOMATIC POWER FAILURE SAFETY SYSTEM

- A. Provide a battery powered Auto-Lowering System.

2.14 MAIN GUIDE RAILS

- A. Provide machine standard (15 lb./ft.), "T" section guide rails with tongue and grooved joints for the car's main rails. Use not less than 3/4" thick steel machined fishplates to form rail joints. Connect rails to fishplates with four (4) bolts. Brackets shall be used to support the rails from the hoistway framing, pre-cast concrete planks and/or inserts. Rails to be attached to the brackets with clips. Provide rail backing where no intermediate support framing is shown on the drawing. All guide rails shall be erected plumb and parallel to a maximum deviation of 1/8" (plus or minus 1/16").
1. Inserts (if used) shall be furnished by Elevator Contractor and installed by others. The Elevator Contractor shall provide the Construction Manager with clear insert location drawings (shaft plan and section).

2.15 CAR SLING

- A. The car frame shall be constructed of structural steel.
- B. Design the car frame for an 8' - 0" overall cab height, (7' - 6" clear cab).

2.16 PLATFORM

- A. The platform shall be steel construction mounted on manufacturer's standard vibration isolation pads. The sub-flooring is to be constructed of one (1) layer of 3/4" exterior-grade plywood. The underside of the platform shall be properly fireproofed with 26 gauge galvanized steel metal in a maximum of two (2) sections.
- B. Provide an extruded aluminum car sill.
- C. Recess the platform as required for the finish flooring.

2.17 CAR GUIDE SHOES

- A. The car frame shall have manufacturer's standard guide shoes attached at the upper and lower portion of the stiles. These roller-guide shoes shall be adjustable, spring loaded type with adjustable mounting base, rigidly bolted to the top and bottom of each side of the car frame.

2.18 BUFFERS

- A. Spring buffers shall be provided in the elevator pit. Means shall be provided for mounting buffers securely on channels at the pit floor.

2.19 HOISTWAY ENTRANCES (REFER TO ARCHITECTURAL DRAWING A-531)

- A. Hoistway entrances of the hollow metal horizontal sliding, single speed type, shall be provided at each hoistway opening. Each entrance shall include 14 gauge stainless steel unit frames (corners to be welded and ground smooth), flush design 16 gauge stainless steel door panels, stainless steel sight guards, extruded aluminum sills, strut angles, headers, hanger covers, fascia plates, toe guards, dust covers and necessary hardware.
- B. Material and Finish shall be as follows:
 - 1. Frames: Painted in a custom color as selected by the Architect.
 - 2. Door Panels: Painted in a custom color as selected by the Architect.
 - 3. Sight Guards: Painted in a custom color as selected by the Architect.
- C. Fasciae, hanger covers, toe guards and dust covers shall be a minimum of 16 gauge and have the manufacturer's standard enamel or galvanized finish. Structural members shall have prime coat finish.
 - 1. Header, Struts and strut extensions shall be a minimum of 10 gauge formed steel.
- D. Sills, struts, headers, hanger covers and unit frames shall be erected prior to the erection

of rough walls and set in proper relation to the car guide rails. Door panels shall be installed after the walls are finished.

- E. Provide keyholes for each landing door in accordance with G.A.L. equipment requirements with stainless steel ferrule insert.
- F. Use sill mounted spring closers.
- G. Provide sill support angles.

2.20 MASTER DOOR OPERATOR

- A. A Master Door Operator with a ½ Hp direct current motor shall be provided to open and close the car and hoistway doors simultaneously, at a maximum speed of not less than 1 ½ feet per second. Door movement shall be cushioned or checked at both limits of travel. An electro-mechanical interlock shall be provided on each hoistway door to prevent the operation of the elevator unless all doors are closed and locked. An electric contact shall be provided on the car door to prevent the operation of the elevator unless the car door is closed.
- B. The door operator shall be arranged so that, in case of interruption or failure of electric power from any cause, the doors can be readily operated by hand from within the car. Emergency devices and keys for operating the doors from the landing shall be provided unless otherwise specified by local codes.
- C. The doors shall open automatically when the car is leveling at the respective landings and shall close after a predetermined time interval or immediately upon pressing a car button. A "Door Open" button shall be provided in the car, the momentary pressing of which shall reopen the doors and reset the time.

2.21 DOOR EDGE PROTECTIVE DEVICE

- A. Provide an infra-red curtain type reopening device with proximity detector that will stop and reopen the car door and hoistway door automatically if the door becomes obstructed by an object or person. The device shall be capable of completing these operations without required contact for an obstruction passing through the opening. The device shall be a non-reflective through beam system with a minimum of forty sensors per edge. It shall have a maximum sensor spacing of 1.8" or less. It shall incorporate a microprocessor controlled fail-safe system. It shall be capable of self-adjustment to compensate for varying environmental conditions. Provide Janus Pana 40 Plus 3D or approved proximity type device.

2.22 DOOR HANGERS AND TRACKS

- A. Hangers and tracks shall be provided at each car and hoistway entrance. Tracks shall be of bar steel with the working surface contoured to match the sheaves. The hangers shall be designed for power operation and have provisions for vertical and lateral adjustment. Hangers shall be designed for two point suspension of the door panel.
- B. Hanger sheaves shall be polyurethane with pre-lubricated and sealed-for-life bearings.

Car door hangers shall have 3 1/4" diameter sheaves. Hoistway door hangers shall have 3 1/4" diameter sheaves.

2.23 INSPECTOR'S OPERATING STATION

- A. An inspector's operating station shall be provided on top of the elevator car consisting of "Up" and "Down" constant pressure buttons, incandescent light with guard, 110 Volt G.F.I. work outlet and an emergency stop switch.

- 1. Provide an additional light with guard and G.F.I. work outlet mounted to the bottom of the car and located towards the front for easy access.

2.24 PIT EMERGENCY STOP SWITCH

- A. An emergency stop switch shall be provided in the elevator pit, designed to cut off current supply to motor and "down" direction valves and bring the car to rest independent of the regular operating devices.

- 1. Locate the pit stop switch in accordance with code.

2.25 ALARM BELL

- A. An electric signal bell shall be provided in or adjacent to the elevator hoistway as directed. This bell shall be connected to the alarm button in the car operating panel.

2.26 CAR OPERATING PANEL

- A. A car operating panel shall be furnished in the car containing illuminating buttons for each landing, flush-mounted Braille tags, emergency car light with flush lens, door open and close buttons, auto-dial telephone station, emergency stop switch, F.E.R. Phase II key switch, indicator light and signage, alarm button and key switches for light, fan and independent service. All fixture components shall be back plate mounted and shall be incorporated into the swing front return panel of the cab.

- 1. The auto-dial telephone unit shall be mounted to the backplate and concealed behind the swing front return. Provide a perforated hold pattern in the swing front return panel for speakers and microphone voice transmission.
 - 2. Provide an L.E.D. position indicator with a minimum 2" high characters.
 - 3. The light, fan and independent service key switch along with a 110 Volt G.F.I. outlet, shall be located in a key-locked service cabinet below the body of the car station. The service cabinet door shall be flush with the swing front return with concealed hinges.

2.27 ILLUMINATED CALL AND CAR BUTTON

- A. Call registration lights shall be provided in each push-button unit. When a button is pressed, it shall illuminate, signaling to the waiting passenger that the call has been registered. Each button shall remain illuminated until the call has been answered.

1. Provide brushed stainless steel buttons throughout. Acceptable manufacturers are EPCO and Monitor. Button finish shall match the finish of surrounding cab swing front return panel.

2.28 CAR LANTERNS

- A. Lanterns with one stroke up, two strokes down gongs shall be provided.
- B. As soon as the car has reached a predetermined distance from a landing and is set to stop at that landing, the corresponding lantern shall be illuminated and the gong shall sound whether the hall button has been pressed or not and the lantern shall remain illuminated until the car has left that landing. All visual and audible signal timing shall be in accordance with A.D.A. requirements.
- C. Provide backplate mounted fixtures with only the lens projections through the swing front return jamb.

2.29 HALL CALL STATIONS

- A. Provide jamb mounted unit with No. 4 stainless steel faceplates with (1/8" thick) beveled edges and tamper proof fasteners.
- B. Provide F.E.R. Phase I key switch at the main egress level.
- C. Include access key switches.

2.30 ELECTRIC WIRING

- A. It shall be the responsibility of the Elevator Contractor to furnish and install complete, necessary, insulated wiring to connect all parts of the equipment. Wiring, conduit, fittings and installation shall be in accordance with Division 16, and comply with the requirements of the National Electric Code.
- B. Insulated wiring shall have a flame retarding and moisture resisting outer cover and shall run in concealed galvanized metal conduit, metallic tubing or wire ducts.
 1. Flexible metal conduit shall be permitted for short runs only.
- C. Traveling cables between car and hoistway shall have a flame retarding and moisture resisting outer cover. They shall be flexible and suitably suspended to relieve strains in the individual conductors. The traveling cable shall also include:
 1. A minimum of 10% spare conductors, (ends to be left accessible to facilitate connections at a later date).
 2. Wiring as required for the auto-dial telephone and firemen's communication (as required per local code).
 3. A video co-axial cable type RG 59U, (leave adequate slack in the machine room and top of car to facilitate final hookup).
 4. Six (6) pairs of 18 gauge shielded cables, (terminating on terminal strips in the controller and in the car operating station).

2.31 TERMINAL LIMIT SWITCHES

- A. Terminal limit switches shall be provided in the hoistway, designed to automatically stop the car at the terminal landings, within the designated top and bottom overtravels.
 - 1. The switches shall be rail mounted with rubber (or similar) rollers which are engaged by a car mounted cam. The beveled section of the cam shall be designed for smooth, quiet engagement of the switches.

2.32 CAR ENCLOSURE

A. Cab Requirements

- 1. Shell

14 gauge steel for walls and 12 gauge steel for canopy. Individual panels shall not exceed 18" in width and shall be reinforced to provide for a flat, rigid surface. Apply spray on sound deadening on rear of shell. Sound deadening material shall be non-combustible and applied in accordance with manufacturer's recommendation. Provide a minimum 1/8" consistent thickness on all surfaces. Provide welded re-enforcement grounds (minimum 1/4" thick with weld nut) on the rear of the shell for handrail mounting. Provide all cutouts in the shell as required for ventilation and fixture installation.
- 2. Interior Panels

Removable panels. MDF board covered in textured stainless steel finish (5HR pattern) as selected by the Architect.
- 3. Front Return Panels

Provide 14 gauge brushed stainless front return panels. The swing return panels and hinging system shall be suitably re-enforced to prevent appreciable or permanent sagging or deflection when opened for maintenance.
- 4. Transom

14 gauge brushed stainless steel suitably reinforced. Apply sound deadening to the back of the transom as specified above.
- 5. Doors

16 gauge brushed stainless steel with full height rubber astragal at the leading edge of each door panel. Provide the same construction as for the hoistway

- | | |
|---|--|
| 6. Sills | doors.
Extruded aluminum. |
| 7. Ceiling | Plastic laminate on minimum 5/8" MDF boards. |
| 8. Exhaust Fan | Two-speed Nylube fan, mounted on vibration isolation pads. |
| 9. Protection Pads (Included in Base Bid) | Provide one (1) set of protection pads for the elevator (cost is included in the base bid). Provide heavy-duty vinyl impregnated nylon with 1/4" thick padding. Pads are to be fire retardant and treated to be self-extinguishing. Include a metal stiffening bar on top of pads and include retaining clips to hold the pads in place. Provide pads in a color as selected by the Architect. |
| 10. Pad Buttons (Included in Base Bid) | Provide extended type stainless steel pad buttons bolted through the shell. Provide weld nuts on rear of shell to accept the pad buttons. |
| 11. Base | 12 gauge brushed stainless steel. |
| 12. Concealed Vent Slots | Design the cab interior to provide for ventilation openings above the base behind the wall panels. Refer to the Architectural drawings. |
| 13. Flooring | By Others. Provide recess to accommodate finish floor thickness. Refer to Architecture Drawings A-531. |
| 14. Reveals, Frieze, Other Exposed Areas | All exposed reveals, friezes, etc. shall be brushed stainless steel. |
| 15. Engraving | No applied plates will be accepted. |
| 16. Logos | No manufacturer's logos shall be visible. |

2.33 PERFORMANCE

- A. Speed to be within 5% of rated speed in both directions of travel and under any load.
- B. Leveling to be within 1/4" of the Hoistway Sill level.
- C. Maximum 400 psi working pressure.

2.34 HANDICAPPED REQUIREMENTS AND COMMUNICATIONS

- A. Locate a door reopening device at 5" and 29" above the finish floor, the alarm button and emergency stop switch at 35" and the floor and control button not more than 54".

- B. Provide raised markings in the panel to the left of the floor and control buttons. Letters and numbers shall be a minimum of 5/8" and raised.03" and shall be in contrasting color to the call buttons. Plates, if used, shall be stud mounted and recessed flush with the car station.
- C. The centerline of the hall push-button station shall be 42" above the floor. The hall lanterns or cab lantern shall sound once for the "up" direction and twice for the "down" direction.
- D. Provide floor designations at each entrance on both sides of jamb at a height of 60" above the floor. Designations shall be 2" high, raised.03" and shall be as selected by the Architect.
- E. Provide an audible signal to tell passenger that the car is stopping or passing a floor served by the elevator.
- F. Provide emergency communications and auto-dial telephone in the elevator cab and machine room. System shall allow for communications between the machine room and cab in accordance with Code. At a minimum, the auto-dial telephone shall include the following features:
 - 1. Fully A.D.A. compliance including "Call Acknowledged Indicator".
 - 2. Powered by phone line only.
 - 3. Two number capability.
 - 4. Automatic location identification message.
 - 5. Non-volatile memory.
 - 6. Remote programming.
 - 7. Adjustable line disconnect timer.
 - 8. Call back capabilities.
 - 9. Communication between machine room and cab.

2.35 MATERIALS

- A. Sheet Steel for Exposed Work: Stretcher-leveled, cold rolled, commercial-quality carbon steel, complying with ASTM A366, matte finish.
- B. Sheet Steel for Unexposed Work: Hot-rolled, commercial quality carbon steel, pickled and oiled, complying with ASTM A569.
- C. Structural Steel Shapes and Plates: ASTM A36 and AISI 1018.
- D. Stainless Steel: Type 300 Series complying with ASTM A167, with standard tempers and hardness required for fabrication, strength and durability. Supply with mechanical finish on fabricated work in the location shown or specified with texture and reflectivity required (Federal and NAAMM nomenclature). Protect with adhesive plastic film or paper covering. All finishes specified as "satin" to be Manufacturer's standard directional polish that complies with commercial No. 4 requirements. All finishes specified as "mirror" to be Manufacturer's standard mirror polish that complies with commercial No. 8 requirements.
- E. Aluminum: Extrusions per ASTM B221; sheet and plate per ASTM B209.

- F. Plastic Laminate: ASTM E84 Class A and NEMA LD3, 0.050" (1.3 mm) up to 1/16" (1.6 mm) nominal thickness. Exposed surfaces to have color selected by Architect from Manufacturer's standard selection.
- G. Fire Retardant Treated Particle Board Panels: Minimum 3/4" (13mm) thick backup for plastic laminate veneered panels provided with suitable anti-warp backing; to meet ASTM E84 Class "A" rating with flame-spread rating of 25 or less.
- H. Paint: Unexposed Steel and/or Iron: Clean metal of oil, grease, scale and other foreign matter and paint one shop coat of Manufacturer's standard rust-resistant primer. Primer shall be of a low V.O.C. water-based type. Galvanized metal need not be painted.
- I. Exposed Steel: Clean exposed metal of oil, grease, scale and other foreign matter. Eliminate any dents, scratches, or other defects that would affect the final finish. For material delivered with primer coat only, apply two coats of manufacturer's standard baked enamel primer. For material delivered with a finished coat, apply an additional two coats of manufacturer's standard baked enamel of a color selected by the Architect from the manufacturer's standard color selection.

PART 3 - EXECUTION

3.1 DESIGN REQUIREMENTS

A. Electrical Design and Wiring:

1. All wiring shall be Underwriters approved stranded type in accordance with the latest International Electrical Code. Minimum size permitted shall be No. 18 AWG. These wires shall be installed in conduit with steel outlet boxes. All electrical boxes (Hall pushbutton boxes, Car Stations, Terminal boxes, pull boxes, etc.) and other similar items shall be of approved construction, hot-dip galvanized or electroplated with Zinc Dichromate. All electrical boxes exceeding 150 cubic inches shall be supported independently of the conduits.
2. All raceway shall be galvanized EMT and/or trough.
3. Furnish all materials and completely wire all parts of the electrical equipment of the elevator, including electrical devices on hatch doors.
4. Switches, relays, etc. on controller, starter, and signal panels and similar items on other parts of the equipment, shall be the latest model. Any parts showing wear or damage during the guarantee period to the extent that abnormal maintenance is required or indicated shall be replaced by the Contractor as part of his Contract obligations.
5. Contacts in elevator motor circuits, which are intended to be opened by the governors or other safety devices, shall be copper to carbon, or other approved non-fusing type. Relays shall be designed for visual inspection and easy replacement of contacts with minimal disassembly, and keyed parts for ease in reassembly. They shall be equipped with suitable blowout coils, vanes, barriers, etc., to prevent undue arcing and heating. Current ratings for silver-to-silver contacts on relays used in motor circuit applications shall be at least three times the current draw of the running ratings of the motor. Contacts on control and signal relays and switches shall generally be of silver alloy.
6. Conduits shall be run and connected to suitable approved connection boxes at all

outlets, apparatus and panels.

7. The conduits shall be of such size that the wires or cables can be readily installed and replaced, if necessary. No conduit or raceway shall be less than 3/4 inch trade size, except that for small devices such as door switches, interlocks, etc. for which, 1/2 inch conduit may be used. The total overall cross-sectional area of the wires contained in any conduit shall not exceed 40 percent of the internal area of the conduit. Approved strain boxes shall be installed for all vertical runs in accordance with Code.
8. Conduits shall be neatly and systematically run. All exposed conduit and boxes shall be supported by straps (wire or plastic ties are not acceptable), hangers, or clamps to the structural steel, reinforced concrete, or other approved supports. Riser conduits and/or trough in hoistway shall be supported at each floor level.
9. Connections of all wires larger than No. 8 AWG shall be made with copper connectors except for Mainline Disconnect switches where UL approved aluminum lugs/connectors may be used. Metal eyelets pressed around the strands shall be used for all connections of smaller stranded conductors.
10. All terminals shall be tagged or identified in a permanent legible manner to match car and hoistway junction boxes and controllers.
11. In all machine rooms, hoistways, etc., install the equipment to allow easy access for maintenance.
12. All screws used for terminal connections of all wiring (machine room, hoistway and pit) shall be of proper size and type as approved.
13. All connections of wires to controller and motor lead terminals from external circuits shall be made with "copper" soldered lugs or "copper" eyelet compression type lugs.
14. All elevator lights (top and bottom of car and pit) and A.C. alarm bells shall be fused and located in the elevator machine room in a separate approved box, or on the controller. The fuses shall be identified (permanent label) "lights and alarm bells".
15. All receptacles in elevator machine room, pits, and car shall be Ground-Fault Circuit-Interrupter type (GFCI).
16. All grounding shall be done in accordance with the latest International Electrical Code as adopted by local jurisdiction. Grounding of machine to bedplate is not permitted.

B. Mechanical Design Requirements:

1. All bearings, pivots, guides, guide shoes, gearing, door hanger sheaves, door hanger tracks, and elements subject to friction or rolling wear shall be accurately finished and arranged for convenient lubrication. Provide means for flushing and draining the larger bearings and gear cases. All oiling holes shall have dustproof, self-closing caps.
2. All bearings shall be sized for heavy-duty commercial elevator usage.
3. Ball and roller bearings shall be fully enclosed. Loading, lubrication, support and all other conditions of use shall be in accordance with the recommendations of the bearing manufacturer. Bearings for motors shall be of the open (non-sealed) type with approved fittings for grease lubrication or approved sealed bearings. The bearings shall not be part of the end bell housing, but shall be separate for easy removal and replacement.
4. All bolts used to connect moving parts, bolts carrying hoisting stresses, and all other bolts except guide rail bolts, subject to vibration or shock, shall be designed to prevent

loosening of the nuts and bolts. Bolts transmitting shearing stresses between machine parts shall have tight body fit in drilled and reamed holes. All bolts subject to vibration shall be provided with split ring lock washers. All guide rail vane brackets shall be through bolted and provided with proper bolts, nuts and lock washers.

5. All parts shall be manufactured to high precision standards so that wearing parts will be readily interchangeable with stock repair parts with a minimum of field fittings.
6. All bearing and sliding surfaces of shafts, pins, bearings, bushings, guides, etc., shall be smoothly and accurately finished. During the maintenance period, all bearings shall be regularly checked for any tendency to run hot and any defects corrected.
7. Protection for moving parts: Belts, pulleys, chains, gears, couplings, projecting set screws, keys, and other rotating parts located so that any person can come in close proximity thereto, shall be fully enclosed or properly guarded.
8. All exposed hardware on public hall side shall be of tamperproof design constructed of stainless steel with No. 4 satin finish.
9. Tamperproof stainless steel spanner head screws shall be used for all exposed locations, for all landing button panels, certificate frames, interlocks and car lighting fixtures. Supply one Spanner head wrench for each size screw. Tamperproof screws shall be of the "captive type". Self-tapping screws or self-tapping machine screws shall not be permitted.
10. All locks and key operated switches shall be five (5) pin tumbler type. All keys where permitted shall be of the captive type. Furnish two (2) keys for each lock and/or switch for each elevator. All locks shall be mastered to one master key. Furnish four (4) master keys. Firemen's Service keys shall meet Local Code requirements.

3.2 WORKMANSHIP AND INSTALLATION

A. Inspection and Tests:

1. Failure to keep the shutdown time within the specified limit may result in cancellation of the contract by the Owner. Any delays in the approved schedule shall be brought immediately to the attention of the Owner, in writing, along with the proposed revised schedule.
2. Arrange and schedule final inspection of all work and notify the Owner in writing that the work has been thoroughly checked and is ready for final inspection. Testing shall be performed under the direction of authorized Inspectors.
3. When the elevator work is completed, conduct operating tests to the satisfaction of the Owner and the appropriate City Agencies having jurisdiction. The inspection procedure outlined in the ASME A17.2 for the Inspection of Elevators, Escalators and Moving Walks, Inspector's Manual will form a part of the final inspection.
4. Furnish all test instruments, labor and materials, required at the time of final inspection. They shall include, but not necessarily be limited to, standard 500 pound test weights.
5. Certificates: Before final acceptance, furnish all certificates required by all Public Agencies having jurisdiction. All certificates shall be turned over to the Owner with copies to the Architect and Consultant.
6. If requested by the Consultant, the following tests shall be made by the Field Engineer or Adjuster of the Elevator Company in the company of the Consultant or the

Consultant's Representative, at the time of final inspection:

- a. FULL LOAD-RUN TEST: Shall be for one hour continuous run, with full specified rated load in the car. During the test run, the car shall be stopped at all floors in both directions of travel for a standing period of ten (10) seconds per floor.
- b. SPEED TEST: The actual speed of the elevator car shall be determined in both directions of travel and with full contract load and no load in the elevator car. Speed tests shall be made before and also after the full load run test. Speed shall be determined by applying a tachometer to the car hoisting cables. The actual measured speed of elevator car with full load in "UP" direction shall be within 5 percent of specified rated speed.
- c. TEMPERATURE RISE TEST: The temperature rise of the hoisting motor shall be determined during the full load test run. Temperatures shall be measured by the use of thermometer on top of windings and shielded by cotton waste or putty. Temperature rise of the equipment shall not exceed the temperature rise for the class of insulation used in the motor tests, shall be started only when all parts of the equipment are within 5° centigrade of the ambient temperature at time of starting test.
- d. CAR STOPPING ACCURACY: Elevator stopping shall be tested for accuracy of landing within 1/2 inch plus or minus (from finished floor) at all floors with no load in car, balanced load in car and full load, in both directions of travel. Accuracy of floor landing shall be determined both before and after the full load run test.
- e. INSULATION RESISTANCE TEST: The complete wiring systems of elevator shall be free from short circuits and grounds, and the insulation resistance of systems determined by use of a "Megger", shall be not less than one megohm. (Solid State Controllers are excluded from this test).
- f. CAR SAFETY AND GOVERNOR TESTS: The car safety and governor shall be tested as outlined in Section 1003 ASME A17.1 Code.
- g. STATIC CAR BALANCING: The car shall be statically balanced in its sling so that the total lateral force on top car guide assemblies shall be a maximum of forty pounds (40 lbs.) for all positions of the car in the shaftway.
- h. DYNAMIC SYSTEM BALANCING: Car and counterweight suspension system shall be dynamically balanced so that total weight of counterweight and its frame shall be equal to total weight of unloaded car and its sling, plus forty percent (40%) of contract load with an accuracy of plus or minus fifty pounds (50 lbs).
- i. ELECTRICAL PROTECTIVE DEVICES: All electrical protective devices in the wiring system (Fuses, Overloads, etc.) shall be tested for proper operation.
- j. The FIREMAN'S SERVICE SYSTEM shall be tested for proper operation.
- k. PASSENGER OVERLOAD TEST: The car shall be tested with 125% of rated load and shall conform to all passenger overload regulations in ASME A17.1. In addition, the car shall be subjected to the Acceptance and 5 Year Tests for Drive Machine Brakes in ASME A17.2.1, Inspectors' Manual for Electric Elevators.
- l. BUFFER TEST: Car and Counterweight Oil Buffers shall be tested in accordance with the requirements for Acceptance and 5 Year Tests for Oil Buffers, as described in ASME A17.2.1, Inspectors' Manual for Electric Elevators.
- m. TEST SECURITY INTEGRATION

B. Cleaning, Adjustment, and Final Acceptance:

1. At the end of each day, remove and legally dispose of all refuse and dirt resulting from work of this contract. All work areas shall be left "broom clean". After completion of work, thoroughly clean and adjust elevators so that they are in proper operating condition. Remove from site, all materials which are not required as part of finished work.

C. Safety of Persons and Property:

1. Plan the work and execute in an organized and orderly manner. Danger and warning signs shall be prominently displayed, and exercise every precaution to protect pedestrians.
2. Erect construction barriers around the work area. Keep dust and noise at a minimum. Barricades shall not have protruding nails or sharp jagged edges.
3. If there are two (2) cars in a common shaft, furnish and install temporary wire screening between elevator hoistways. The screening shall be full depth and height of the elevator hoistways and shall be fastened to wood blocking which, in turn, is securely fastened to the Building structure. Wire screening shall be $\frac{1}{2}$ " x $\frac{1}{2}$ " #19 (.041 dia) galvanized wire mesh. All wire screening, wood blocking, protruding nails, etc. shall be removed after completion of work. Damaged concrete shall be repaired.

D. Protection:

1. Protect all items against dirt and damage. The Contractor shall be held fully responsible for all damage until final acceptance. Any equipment or property of the Owner damaged by this Contractor or his employees shall be restored to its original condition or replaced without cost to the Owner.

E. Contractor's Shop:

1. The successful bidder, shall, before being awarded this Contract, prove to the Owner to its satisfaction that he maintains or has access to an adequate shop within a twenty (20) mile radius of the project, carry in stock, all spare parts furnished under this Contract which are subject to periodic failure.

F. Storage:

1. The Owner will designate a suitable area where the Contractor may store equipment until the work is completed. All equipment shall be stored at the sole risk of the Contractor.
2. The Contractor shall provide his own lock and key. The assigned storage area shall be left clear and unencumbered of material or debris and shall be left in a broom-clean condition at the completion of the work. An approved Type "C" fire extinguisher shall be provided and installed on a wall, for each storage area assigned to the Contractor.

G. Access to Elevator Equipment:

1. The Contractor shall provide keys for access to all the elevator equipment.

H. Punch List Items:

1. All punch list items shall be completed within thirty (30) consecutive calendar days of

receipt of Punch List items.

3.3 SHAFT CLEANING

- A. The entire shaft, from the pit floor to the underside of the machine room slab, shall be thoroughly cleaned of all debris, lint, grease, dust, etc.

3.4 HOISTWAY PROJECTIONS

- A. Provide seventy-five (75°) degree concrete bevels on all ledge projections in excess of two inches of all elevator hoistways on all floors.

3.5 PAINTING

- A. Summary of Work Included:

1. Clean all ironwork and paint with one shop coat of primer coating. Do not paint galvanized steel with enamel coating. After erection, touch up bare spots on iron work. Apply final field coat of paint similar to shop coat.
2. Touch up any wall and ceiling surfaces damaged by work of this project with at least two coats of paint to match finish.
3. Paint metal with one coat of an oil based rust inhibitive primer and one coat of an enamel alkyd paint.

- B. Samples:

1. Before placing orders for materials, submit the name or names of manufacturers for approval.
2. Upon approval of the manufacturer, submit samples of all materials. Approval of the samples will be based upon manufacturers certifying that the products proposed are the standard best or top brands produced by them and are readily obtainable as such in "over the counter" sales. Do not proceed until all samples are approved.
3. All materials shall be further subject to field tests from time to time as the work progresses.

- C. General Painting Requirements

1. Delivery: Deliver all material in their original containers with seals unbroken. Order in advance, in large enough quantities and in ample time to facilitate the work.
2. Storage of Materials: Store materials where directed. Keep storage space clean and accessible at all times. Remove paint or oil-soaked rags, waste, etc. from the premises at the close of each day's work. Absolutely no flammable or combustible materials are to be stored on the Owner's property.
3. Protection: Provide suitable coverings to protect all work and all adjacent surfaces and objects.
4. Cleaning Up: Upon completion of the work, remove all surplus materials, empty containers, rags, and other debris from the premises. Touch up finished work where directed. Remove daubs or spatters of paint from all surfaces.

D. Workmanship:

1. Carefully prepare all surfaces to be painted. Do not apply paint until the surfaces are absolutely dry and clean.
2. Shop or priming coats shall be put in good condition; touch up any bare or abraded spots.
3. Wire brush all metal surfaces. Remove all abrasions in the prime coat, rust, scale, etc. Clean and touch up damaged areas to match prime coat. Clean metal work with solvent to remove all dirt and grease.
4. Clean concrete and masonry surfaces to be painted of all grit, dirt and loose material. Patch scratches, cracks, holes and similar defects in wall and ceiling surfaces to provide a smooth flush surface. Patched portions shall be given a coat of primer sealer in addition to all other specified coats.
5. Allow each coat of paint to dry before subsequent coat is applied. The finished work shall be free from runs or sags, defective brushing or brush marks, and clogging of lines and angles. Exposed surfaces shall be left clean.

END OF SECTION

SECTION 210000 – FIRE PROTECTION

210001 GENERAL

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this section.
- B. Contractor shall provide coordination drawings per Division 1.
- C. Fire Protection work shall be performed as outlined in “Information for Bidders”.
- D. These specifications and the accompanying fire protection drawings are intended to provide for all labor, materials and equipment necessary for the installation of a complete
 - 1. Wet-pipe sprinkler system
 - 2. Dry-pipe sprinkler systemand accessories including necessary apparatus, valves and fittings hereinafter described or called for on the fire protection drawings accompanying these specifications.
- E. All fire protection work shall be installed in accordance with the following Codes and all Local Ordinances. Codes shall be latest editions approved by the NC Building Code Council with North Carolina amendments. Materials, equipment and workmanship shall be as hereinafter specified.
 - 1. North Carolina State Building Code
 - 2. North Carolina State Fire Prevention Code
 - 3. NFPA 70
 - 4. NFPA 13
- F. All products used as part of the installation of the fire sprinkler system shall be Underwriter’s Laboratories (UL) or Factory Mutual (F.M.) approved as required by NFPA 13.
- G. This contractor shall secure all required permits and inspection fees necessary for this work. Permits may be secured from the Building Inspections Department.
- H. The accompanying drawings are schematic only and are not intended to show all fittings, couplings, hangers, offsets, etc., unless specifically dimensioned. The layout shown on the drawings is a conceptual layout only. This contractor shall provide complete installation drawings for the sprinkler systems defined herein, per the Contract Drawings and these specifications. Provide all adjustments as necessary to conform to the structural conditions, machinery, equipment, work of other contractors and the intent of the drawings, without additional cost to the Owner. Fire protection consultant drawings should not be scaled. Secure dimensions from Architectural drawings. Refer to drawings of other trades and coordinate with other contractors. All equipment shall be installed in accordance with the manufacturer’s published installation instructions and diagrams.

- I. The Contractor shall coordinate the exact location of incoming sprinkler riser rough-in with Division 33, and all other trades.

210002 SCOPE OF WORK

- A. The Contractor shall be required to perform all the following work, in general and provide a complete fire sprinkler system(s) as shown on the plans. This Contractor's scope of work begins at the sprinkler riser rough-in(s) provided by others, approximately one foot above the finished floor. The items in general are to be as follows:
 1. Furnish and install complete wet-pipe sprinkler system as shown on the fire protection drawings and here-in specified.
 2. Furnish and install complete dry-pipe sprinkler system as shown on the fire protection drawings and here-in specified.
 3. Sprinkler Contractor is responsible for acquiring flow test data, less than one year old, from the local Fire Department, local Water Department, or by performing a flow test. Contractor shall coordinate with and get approval of date, time, and location of flow test from the local Fire Department.

210003 LIST OF MATERIALS, FIXTURES AND EQUIPMENT

- A. Sprinkler system design submittal, including shop drawings, hydraulic calculations, and materials, shall be performed by a Professional Engineer registered in the State of North Carolina, or an individual who has Level III or IV certification from the National Institute for Certification in Engineering Technologies (NICET) in Fire Protection Engineering Technology: Water-Based Systems Layout in accordance with NICET 1014.
- B. The Sprinkler Contractor shall obtain written approval from the Engineer/Architect for the use of substitute materials claimed as equal to those specified. Such approvals must be obtained as soon after contract awards as possible and before any materials are ordered. Applications for approvals shall be made by the Sprinkler Contractor and not by subcontractors or manufacturer's representative. The Sprinkler Contractor shall submit within ten days following award of contract and written notice to begin the work a complete list of materials proposed for the job. All like items shall be by the same manufacturer. When this list is approved, no further substitutions will be permitted except in unusual or extenuating circumstances. If no list is submitted, the Sprinkler Contractor shall supply materials specified. The Sprinkler Contractor shall review and stamp the submittals as being in accordance with his or her bid and these specifications.
- C. The Sprinkler Contractor shall submit a set of installation plan drawings to the Architect before any materials, and equipment to be incorporated in the work has been ordered. **FAXED COPIES WILL NOT BE ACCEPTABLE.** Installation plan drawings shall include:
 1. Hydraulic design data, including remote area designation(s), and locations of nodes.
 2. Flow test data.

3. All piping, included mains, cross mains, branches, and armovers with sizes indicated.
 4. Locations of couplings on grooved piping.
 5. Location of Riser(s).
 6. Riser Details.
 7. Hanger Details.
 8. Locations of sprinkler heads.
 9. Sprinkler head legend, indicating the manufacturer and model number of each type of sprinkler head.
 10. Location of fire pump.
 11. Location of backflow preventer.
 12. Location of fire department connection and associated check valve.
 13. Location of backflow preventer test header.
 14. Location of inspector's test connection(s).
 15. Location of auxiliary drains.
 16. Locations of seismic bracing, as well as seismic bracing details, as applicable.
 17. Site diagram indicating water supply piping location, sizes, and hydraulic calculation nodes.
 18. Preparer's NICET Certification ID or Professional Engineer Seal.
 19. Coordination Drawings per Division 1.
- D. The Sprinkler Contractor shall submit seismic bracing calculations.
- E. The Sprinkler Contractor shall submit a set of hydraulic calculations to the Architect before any materials, and equipment to be incorporated in the work has been ordered. Hydraulic Calculations shall be performed using computer-based software, such as HydraCALC or HASS. **FAXED COPIES WILL NOT BE ACCEPTABLE.** Hydraulic Calculations shall include:
1. Required water density and size of remote area(s), in accordance with NFPA and the Authority Having Jurisdiction.
 2. Pressure and flow required for the system(s) to operate properly (after hose allowance has been added).
 3. Flow test data. Sprinkler Contractor shall reduce the static pressure, residual pressure, and flow by 10% when performing hydraulic calculations, per the AHJ.
 4. Node by node analysis of required pressure, required flow, friction losses, and elevation.
 5. Flow vs. pressure curves, indicating that sprinkler system curve(s) are sufficiently below flow test curve.
- F. The Sprinkler Contractor shall submit a set of manufacturer's submittal data to the Architect before any materials, and equipment to be incorporated in the work has been ordered. **All sprinkler system components shall be UL listed and/or FM approved as required by NFPA 13.** Shop drawings shall include the name and address of the manufacturer and their catalog numbers and trade names clearly marked. All items shall be referenced to the specifications by **specification paragraph number on an index tab**. One complete set of submittal data shall be manufacturer's original published material. **FAXED COPIES WILL NOT BE ACCEPTABLE.** Approval of materials will be based upon the manufacturer's published ratings. Submit shop drawings and/or catalog data for the following material and equipment:

1. Sprinkler Heads
2. Piping, Fittings, and Couplings
3. Valves
4. Gauges
5. Hangers
6. Seismic Bracing
7. Riser Check Valve
8. Dry Riser Valve
9. Flow Switch
10. Backflow Preventer Test Header
11. Fire Department Connection

- G. Approval of shop drawings and/or submittal data shall not relieve the Sprinkler Contractor of the responsibility to comply with the requirements and intent of the plans and specifications with regard to dimensions, capacities, quality, quantity, performance characteristics, etc. If data submitted deviates from the contract documents, the Sprinkler Contractor shall point out such deviations in writing and also state reasons for same. All similar items shall insofar as possible be one make and manufacturer. **MANUFACTURER'S MODEL NUMBERS LISTED WITHIN DIVISION 21 SPECIFICATIONS ARE PROVIDED FOR GENERAL INFORMATION ONLY.** Description of product shall take precedence over model numbers.
- H. Prior to submitting equipment information, the Contractor shall field verify all necessary dimensions to ensure that all equipment will fit within designated rooms and/or spaces with proper clearances.
- I. Failure to submit materials, equipment, etc., the Architect shall assume that all items shall be installed as specified.

210004 WORKMANSHIP

- A. Layout:
1. Furnish and install all necessary sleeves, inserts, etc., for walls and partitions. Failure to install such items in time to avoid delaying the general contractor shall result in the Contractor doing all cutting and repairing at his or her own expense.
 2. Conceal piping above ceilings. Where piping is installed in areas without ceilings, coordinate with all other exposed items.
 3. Provide sprinkler protection below all obstructions 4'-0" and wider per NFPA 13.
 4. The General Contractor shall paint exposed piping per Division 9 to match surroundings. Sprinkler heads shall not be painted. Any sprinkler head that is painted shall be removed and replaced.
 5. All equipment shall be installed in accordance with manufacturer's installation written instructions.
 6. All equipment shall be installed such that components do not provide a safety hazard to occupants who come within a close proximity.
- B. All equipment and components located on site shall be protected from the weather and damage from construction equipment.

C. Wet-pipe sprinkler system piping:

1. Piping shall be installed level, without slope, unless otherwise indicated on Contract Drawings.
 - a) Exception: Piping installed immediately below sloped roofs shall match the slope of the roof.
 - b) If sloped piping causes water to be trapped from draining in quantities exceeding 5 gallons, an auxiliary drain shall be provided in an accessible location.
2. Run all piping as directly as possible, avoiding unnecessary bends and turns so as not to interfere with proper installation of work of other contractors.
3. All piping shall be routed with a minimum clearance of ten (10) feet from any electrical switchboards, panel boards or telephone backboards.
4. Piping shall be concealed in walls, or above ceilings, unless otherwise indicated on Contract Drawings.
 - a) No sprinkler piping shall be covered or concealed until inspected by the Authority Having Jurisdiction, and tested and approved by the Architect.
5. Piping shall not be installed underground.
6. Sprinkler heads shall be installed in the center of ceiling tiles.
7. Sprinkler heads shall be installed on armovers to allow their locations to be adjusted to the center of ceiling tiles.
8. Sprinkler mains, cross mains, and branches shall be at least 1-1/4" in diameter and armovers shall be at least 1" in diameter.
9. Support horizontal black steel pipe with hangers located every 12 feet for piping 1-1/4" or smaller and every 15 feet for all piping 1-1/2" or larger.
10. Armovers longer than 24" shall be supported by hangers per NFPA 13.

D. Dry-pipe sprinkler system piping:

1. Piping shall be installed to slope back to the riser. Mains shall be installed at a slope of 1/4 inch per 10 feet, and branch lines shall be installed at a slope of 1/2 per 10 feet, unless otherwise indicated on Contract Drawings.
 - a) Exception: Piping installed immediately below sloped roofs shall match the slope of the roof.
 - b) If sloped piping causes water to be trapped from draining, an auxiliary drain shall be provided in an accessible location.
2. Run all piping as directly as possible, avoiding unnecessary bends and turns so as not to interfere with proper installation of work of other contractors.
3. All piping shall be routed with a minimum clearance of ten (10) feet from any electrical switchboards, panel boards or telephone backboards.
4. Piping shall be concealed in walls, or above ceilings, unless otherwise indicated on Contract Drawings.
 - a) No sprinkler piping shall be covered or concealed until inspected by the Authority Having Jurisdiction, and tested and approved by the Architect.
5. Piping shall not be installed underground.
6. Sprinkler heads shall be installed in the center of ceiling tiles.

7. Sprinkler mains, cross mains, and branches shall be at least 1-1/4" in diameter and piping serving individual heads shall be at least 1" in diameter.
8. Support horizontal black steel pipe with hangers located every 12 feet for piping 1-1/4" or smaller and every 15 feet for all piping 1-1/2" or larger.

210005 CUTTING, PATCHING AND CHASING

- A. All cutting and patching shall be in accordance with the "General Conditions" of these specifications.

210006 SEISMIC RESTRAINTS

- A. The Contractor shall be responsible for providing restraints to resist the earthquake effects on the sprinkler system(s), per NFPA, local codes, and the Authority Having Jurisdiction. Restraints shall be per Seismic Design Category C.
- B. The Contractor shall retain the services of a Professional Engineer registered in the State of North Carolina, or an individual who has Level III or IV certification from the National Institute for Certification in Engineering Technologies (NICET), to design seismic restraint elements required for this project. The engineer's (or NICET-certified individual's) computations, bearing his or her professional seal or NICET Certification Number, shall accompany shop drawings that show Code compliance. Computations and shop drawings shall be submitted for review prior to the purchasing of materials, equipment, systems and assemblies.
- C. The Professional Engineer (or NICET-certified individual) retained by the Contractor for seismic restraint calculations, shall visit the job site upon completion of the seismic restraint installation. This engineer (or NICET-certified individual) shall provide in writing verification of compliance with the approved seismic submittal. This verification shall bear the Engineer's (or NICET-certified individual's) professional seal or NICET Certification Number. Job site inspections by other than this engineer (or NICET-certified individual) is not acceptable.
- D. Review of the seismic design and shop drawings by the Engineer/Architect or their agent shall not relieve the Contractor of his or her responsibility to comply with the seismic or any other requirements of the North Carolina State Building Code.

210007 WET-PIPE SPRINKLER SYSTEMS

- A. Piping:
 1. Sprinkler piping 2" and smaller (minimum 1") shall be Schedule 40 threaded black steel, conforming to ASTM A 795 and ANSI/ASTM A 53.
 2. Sprinkler piping 2-1/2" and larger shall be Schedule 10 roll grooved black steel, conforming to ASTM A 795 and ANSI/ASTM A 53.
- B. Fittings:
 1. Fittings for threaded black steel piping shall be cast iron threaded fittings.

2. Fittings for grooved black steel piping shall be ductile iron grooved fittings conforming to ASTM A 536. Fittings shall be joined with rigid ductile iron couplings.
- C. Contractor may opt to use flexible sprinkler hose fittings in lieu of armovers. Flexible sprinkler hose fittings shall adhere to UL 1474, and be rated for 175 psi. Provide bracket for connection to ceiling grid. Flexible sprinkler hose fitting sizes shall be determined by Contractor's hydraulic calculations, using manufacturer's published data for equivalent length of black steel pipe. Minimum size 1".
- D. Riser:
1. Riser check valve shall have grooved connections and be rated for 250 psi, with upstream and downstream pressure gauges, and main drain valve piped to exterior of the building.
 2. Electric vane-type water flow alarm switch shall consist of a U bolt and saddle with non-corrosive insert for mounting to the pipe, a non-corrosive vane and trip stem assembly for detecting waterflow and a retard time delayed switch to prevent false alarms from water surges. Waterflow switch enclosures shall be NEMA 4 rated and shall be held captive by tamper resistant screws. It shall be possible to install an optional cover tamper switch to detect removal of the enclosure. The device shall be listed for pressures up to 450 psi, maximum water surges of 18 fps and alarm activation by 10gpm. Activation shall be accomplished by the continuous flow of water against a non-corrosive paddle attached to a non-corrosive stem operating a field replaceable instantly recycling adjustable retard with a 0-90 second range and visual indication of activation. Expiration of the retard time shall result in the simultaneous operation of two sets of single pole double throw (SPDT) switch contacts rated at 10A, 125VAC and 2A, 30VDC. Each switch contact shall have a separate wiring chamber and separate conduit entrance to comply with the separation of power limited and non-power limited conductors without the need for special wire or wire methods.
 3. Control Valves shall be ductile iron butterfly valves with grooved ends.
 4. Alarm bell shall have under dome strikers and operating mechanisms. Gong shall have an operating voltage of 24VDC. Bell shall be surface mounted on exterior of building and have weatherproofed electrical box.

210008 DRY-PIPE SPRINKLER SYSTEMS:

- A. Piping:
1. Sprinkler piping 2" and smaller (minimum 1") shall be Schedule 40 threaded black steel, conforming to ASTM A 795 and ANSI/ASTM A 53.
 2. Sprinkler piping 2-1/2" and larger shall be Schedule 40 cut grooved black steel, conforming to ASTM A 795 and ANSI/ASTM A 53.
- B. Fittings:
1. Fittings for threaded black steel piping shall be cast iron threaded fittings.
 2. Fittings for grooved black steel piping shall be ductile iron grooved fittings conforming to ASTM A 536. Fittings shall be joined with rigid ductile iron couplings.

C. Riser:

1. Dry pipe valve shall be low differential type, and have flanged or grooved inlet and outlet connections and be rated for minimum 175 psi, with water side and air side pressure gauges, trim including alarm test valve, air control valve, air relief valve, priming water valve, prime test valve, ball drip valve, and electric alarm pressure switch connections, accelerator and main drain valve piped to exterior of the building.
2. Air Compressor shall be sized by Contractor based on volume of system. Provide tank mounted compressor, air maintenance device, and air dryer(s).
3. Alarm bell is specified under "Wet-Pipe Sprinkler Systems".

210009 FIRE PUMPS

- A. Fire Pump has been specified as part of Package 1.

210010 HANGERS

- A. Hangers for vertical piping shall be the Riser Clamp design.
- B. Hangers for horizontal piping shall be hanger rings attached to top beam clamps using 3/8" threaded rod. Top beam clamps shall only be attached to the top portion of structural members. All hangers shall permit adequate adjustment after erection while still supporting the load.
- C. Trapeze hangers are allowed only where it is necessary due to the required piping layout and structure.
- D. Trapeze hangers shall attach to the structure using top beam clamps located on both sides of trapeze hanger. Top beam clamps shall only be attached to the top portion of structural members.
- E. Hangers **SHALL NOT** be fastened to joist bridging or roof deck.

210011 VALVES

- A. Valves not specified elsewhere in Division 21 shall be UL listed and/or FM approved as required by NFPA 13, and shall be listed specifically for fire protection service.

210012 PIPE SLEEVES, PLATES, ESCUTCHEONS, ETC.

- A. Pipe sleeves shall be standard weight schedule 40 black steel. All sleeves shall be equal to construction thickness except that pipe sleeves passing through floors above grade, shall extend 3/4" above the finished floor. Pipe sleeve sizes shall be sized two pipe sizes larger than piping passing thru the sleeve.
- B. Piping thru non-fire rated walls, floors above slab on grade or ceilings shall have sleeves installed concentric and centered on pipe. Ream all sleeves to prevent cutting

of piping. The Contractor shall furnish shop drawings to the general contractor and the Architect showing location, dimensions, and sizes of holes required.

- C. Install escutcheons snug against room finish on all exposed pipe passing through walls, floors above slab on grade or ceilings. Use cup type escutcheons at floors where sleeves extend above finished floors. Escutcheons shall be chrome plated steel with spring clip as by Keeny, Connecticut Stamping and Bending Company of Dearborne.
- D. Core drill openings for all floor openings may be utilized in lieu of sleeved openings. All openings shall be sized two pipe sizes larger than pipe passing thru the opening. All cored openings shall be fireproofed as required and shall be made water tight.
- E. All penetrations in rated floors, firewalls and any other rated separations shall be protected using a through-penetration firestopping method with an "F" rating equivalent to the rating of the membrane being penetrated for particular piping materials used and membrane construction type. Floor penetrations shall additionally have a "T" rating equivalent to the rating of the floor being penetrated. Through-penetration firestop systems shall be installed and tested in accordance with ASTM E814 or UL 1479 with a minimum positive pressure differential 0.01 inch w.g. All openings through horizontal fire separations shall be protected by Metacaulk U.L. Systems or approved U.L. listed system by other manufacturers.
- F. All openings through floors and vertical fire separations shall be protected by combination water seal and fire stops as manufactured by Presealed Systems or approved equal by Proset, or approved equal by Metacaulk or 3M.

210013 SPRINKLER SYSTEM IDENTIFICATION:

- A. Each individual riser shall be marked with a metal hydraulic placard containing the following data:
 - 1. Location of area protected by riser.
 - 2. Total number of sprinkler heads connected to riser.
 - 3. Design density and design area, as approved.
 - 4. Required flow rate and pressure at the base of the riser, as approved.

210014 SPRINKLER HEADS

- A. Sprinkler head types shall be as indicated on the Contract Drawings, and shall be listed for the proposed application.
- B. All sprinkler heads shall be quick response type, unless otherwise indicated on the Contract Drawings.
- C. All sprinkler heads shall be glass bulb type.
- D. Sprinkler heads shall have ordinary temperature classification, unless otherwise indicated on the Contract Drawings, or required by NFPA 13.

- E. K-Factor of sprinkler heads shall be 5.6 or 8.0.
- F. Provide spare sprinkler head cabinet with a spare sprinkler heads of each type installed within the building, as required by NFPA 13. Provide at least one wrench of each type required.

210015 PROTECTION OF WORK AND EQUIPMENT

- A. The Contractor shall be responsible for all work damaged by him or her. Any fire sprinkler system work damaged by any other contractor shall be replaced by the Contractor and placed in perfect working condition without extra cost to the Owner. All sprinkler heads, valves, pipe, fittings, and equipment shall be adequately protected before, during and after installation.
- B. The Contractor shall be responsible for all sprinkler heads, valves, pipe, fittings, and equipment at time of final inspection. Any broken items will be replaced by the Contractor at no cost to the owner regardless of by whom the item was broken.

210016 TESTING

- A. The Contractor shall notify the Engineer forty-eight (48) hours in advance of all tests. The Contractor shall make all necessary preliminary tests to ensure a functional system, which shall include flushing, testing, and inspection of sprinkler systems according to NFPA 13, "Systems Acceptance" Chapter.
- B. All tests shall be applied before any work is concealed or covered in any manner.
- C. All tests shall be conducted with regard to safety of all personnel on site.
- D. The Authority Having Jurisdiction shall be alerted to and invited to witness all Division 21 tests.
- E. Preliminary Tests:
 - 1. All sprinkler piping shall be made tight under a hydrostatic test pressure of 50 psi greater than the required design pressure, or 200 psi, whichever is greater. Hydrostatic test pressure shall be maintained without pressure loss for a minimum of two (2) hours. No caulking of joints will be permitted. Test pressure shall be read from a gauge located at the low elevation point of the system that is under test pressure. Any joint found to leak under this test shall be broken, remade and a new test applied.
 - 2. Dry sprinkler systems shall also be subjected to an air pressure leakage test at 40 psi for a minimum of twenty-four (24) hours.
 - 3. Waterflow detecting devices, including associated alarm circuits, shall be flow tested using the inspector's test connection. Alarm bell must be audible on premises within five (5) minutes of fully opening inspector's test connection. Each water-operated alarm device shall be tested to verify proper operation.
 - 4. Each tamper switch shall be tested by operating the associated valve.
 - 5. Following flushing of the underground piping, a main drain test shall be made to verify the adequacy of the water supply. Static and residual pressures shall be

- recorded and submitted. In addition, a main drain test shall be conducted each time after a main control valve is shut and opened.
6. Energize circuits to electrical equipment and devices.
 7. Verify that equipment hose threads are same as local fire department equipment.
 8. Dry pipe valves shall be tested using the inspector's test connection. The time it takes for the dry pipe valve to trip, as well as the time it takes for water to flow from the inspector's test connection after inspector's test connection is fully opened shall be measured.
 9. Main drain valves shall be opened until the system pressure stabilizes.
 10. All control valves shall be fully opened and closed under system water pressure to ensure proper operation.
 11. All alarms, supervisory signals, and trouble signals that are related to the sprinkler system and/or fire pump system shall be activated and verified.
- F. A final acceptance test shall be conducted, only after all above tests have been successfully conducted and reports have been submitted and approved, in which a technician employed by the installing Sprinkler Contractor shall provide a complete demonstration of the operation of the system. This demonstration shall include operation of control valves and flowing of inspector's test connections to verify operation of associated waterflow alarm switches, as well as a subsequent main drain test to verify that the control valves are in the open position. The technician shall have a copy of all "as-built" drawings, as well as certificates of previously conducted tests listed above. The sprinkler system installation shall not be considered accepted until as identified problems have been corrected, and the system is successfully retested. It is also required that the test documentation is properly completed and received prior to system acceptance.
- G. Prior to making a request of Beneficial Occupancy the Sprinkler Contractor shall submit written test reports and certificates as required by NFPA 13 and 24. Submittals shall include system acceptance forms copyrighted by NFPA which shall bear the NFPA copyright symbol. No other forms shall be considered.
- H. Sprinkler piping system will be considered defective if it does not pass tests and inspections. Replace damaged and malfunctioning controls and equipment, and retest as necessary.
- I. The Contractor shall furnish all necessary equipment, materials and labor to perform the above-specified tests. All equipment and materials shall be in excellent condition.

210017 PLACING IN SERVICE

- A. The Contractor shall furnish Owner's representative with Contractor's Material and Test Certificate, per NFPA.
- B. The Contractor shall place the entire system in a satisfactory operating condition and shall furnish all assistance and instructions required by the Owner's representative during initial operating period.

210018 ELECTRICAL WIRING

- A. Equipment connections to alarm systems shall be provided by Fire Alarm Contractor.

210019 OPERATING AND MAINTENANCE MANUAL

- A. Four (4) complete sets of all operation and maintenance manuals **shall** be delivered by the Contractor to the Owner thru the Architect. The manuals **shall** be installed in 3-ring hard cover heavy duty notebooks with the name of the project and the words **“Operation and Maintenance Manual”** permanently affixed to the **cover** and **spine**. All items for the project shall be separated by identification tabs correlated to the index. The manuals **shall** contain the following items as a minimum:
1. Index and page number.
 2. Certificate of substantial completion.
 3. A summary sheet of warranties with dates noted and a copy of all warranties.
 4. List of subcontractors and suppliers with names, addresses, and phone numbers.
 5. All documented results of preliminary and system acceptance testing.
 6. Complete start-up, operation, and shutdown procedures for each system including sequence of events, locations of switches, emergency procedures, and any other critical items
 7. Lubrication schedules and types of lubricants.
 8. Complete set of Sprinkler Contractor's record drawings and hydraulic calculations.
 9. Equipment summary showing all capacities and ratings (HP, KW, etc.).
 10. Operation manuals, installation manuals, and parts list for all installed equipment.
 11. All submittal data indexed with tabs.
 12. Copy of NFPA 25, edition to match that which is currently enforced by the Authority Having Jurisdiction.
- B. One copy shall be manufacturers original published literature with manufacturers name on all items. **FAXED COPIES WILL NOT BE ACCEPTABLE.**
- C. Contractor shall provide training for the Owner's maintenance personnel covering the operation and maintenance of the sprinkler system.
- D. Contractor shall provide training for the Owner's maintenance personnel covering the operation and maintenance of the sprinkler system.

210020 AS BUILT DRAWINGS

- A. The General Contractor and Sprinkler Contractor shall maintain “during the course of the work” a set of drawings marked up to show the work as installed. Both Contractors shall initial and date all changes to the contract drawings. The Architectural Observer may check this set of documents monthly for compliance. Upon completion of the work, Sprinkler Contractor shall use these as-built drawings to create a set of record drawings which shall be delivered to the Architect.

- B. A printed set of record drawings, along with hydraulic calculations updated as necessary due to field changes, shall be placed within a white PVC tube marked "Fire Sprinkler Shop Drawings" and securely fixed in the first sprinkler riser room.
- C. A second set of printed record drawings shall be provided to the Owner, as well as electronic copies of the record drawings and updated hydraulic calculations in PDF form.

210021 GUARANTEE

- A. Guarantee: The Contractor shall guarantee the entire fire sprinkler system subject to the General Conditions of these specifications.

210022 BIDDING PROCEDURE

- A. The Contractor shall provide bidding for Alternate Bids in accordance with Division 1. Contractor shall refer to Division 1 for any required unit prices and allowances.

END OF SECTION 210000

SECTION 220000 – PLUMBING

220001 GENERAL

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this section.
- B. Contractor shall provide coordination drawings per Division 1.
- C. Plumbing work shall be performed as outlined in “Information for Bidders”.
- D. These specifications and the accompanying plumbing drawings are intended to provide for all labor, materials and equipment necessary for the installation complete of all:
 - 1. Plumbing Fixtures
 - 2. Equipment
 - 3. Rough-Ins
 - 4. Waste and Vent System
 - 5. Grease Interceptor
 - 6. Condensate Drainage System
 - 7. Cold Water System
 - 8. Hot Water System
 - 9. Fuel Gas System
 - 10. Roof Drainage Systemand accessories including necessary apparatus, valves and fittings hereinafter described or called for on the plumbing drawings accompanying these specifications.
- E. All plumbing work shall be installed in accordance with the following Codes and all Local Ordinances. Materials, equipment and workmanship shall be as hereinafter specified.
 - 1. North Carolina State Plumbing Code
 - 2. North Carolina State Fire Prevention Code
 - 3. National Electric Code
 - 4. North Carolina State Fuel Gas Code
 - 5. ICC A117.1
 - 6. NSF Standard # 61
- F. This contractor shall secure all required permits and inspection fees necessary for this work. Permits may be secured from the Building Inspections Department.
- G. The accompanying drawings are schematic only and are not intended to show all fittings, bolts, connections, offsets, etc., unless specifically dimensioned. Follow drawings as closely as possible, provide all adjustments as necessary to conform to the structural conditions, machinery, equipment, work of other contractors and the intent of the drawings, without additional cost to the Owner. Plumbing drawings should not be scaled. Secure dimensions from Architectural drawings. Refer to drawings of other trades and coordinate with other contractors. All items of equipment shall be

installed in accordance with the manufacturer's published installation instructions and diagrams.

- H. The Contractor shall coordinate water and sewer taps and pay all fees in conjunction to provide services as required, for this project.

220002 SCOPE OF WORK

- A. The Contractor shall be required to perform all the following work, in general and provide a complete plumbing system as shown on the plans. The items in general are to be as follows:
1. Furnish and install complete waste and vent system with connections to services as shown on the plumbing drawings and here-in specified.
 2. Furnish and install cold water system complete with connections to point as shown on the plumbing drawings and here-in specified.
 3. Furnish and install hot water system complete with connections to equipment as shown on the plumbing drawings and here-in specified.
 4. Furnish and install fuel gas piping system with connections to equipment as noted and/or as shown on the plumbing drawings and here-in specified.
 5. Furnish and install roof drainage leader system as shown on the plumbing drawings and here-in specified.
 6. Furnish and install condensate drainage system as shown on the plumbing drawings and here-in specified.
 7. Provide connections to equipment furnished and installed by General Contractor or Owner as shown on the plumbing drawings and here-in specified.

220003 LIST OF MATERIALS, FIXTURES AND EQUIPMENT

- A. The Plumbing Contractor shall obtain written approval from the Engineer/Architect for the use of substitute materials claimed as equal to those specified. Such approvals must be obtained as soon after contract awards as possible and before any materials are ordered. Applications for approvals shall be made by the Plumbing Contractor and not by subcontractors or manufacturer's representative. The Plumbing Contractor shall submit within ten days following award of contract and written notice to begin the work a complete list of materials proposed for the job. All like items shall be by the same manufacturer. When this list is approved, no further substitutions will be permitted except in unusual or extenuating circumstances. If no list is submitted, the Contractor shall supply materials specified. *Contractor should note that all items specified in section 220000 shall be submitted independently of other 220000 series sections.* The Plumbing Contractor shall review and stamp the submittals as being in accordance with his bid and these specifications. **Private labeled materials are not acceptable.**
- B. The Plumbing Contractor shall submit shop drawings to the Architect after award of the contract, and before any materials, fixtures, and equipment to be incorporated in the work has been ordered. Shop drawings shall include the name and address of the manufacturer and their catalog numbers and trade names clearly marked. All items shall be referenced to the plans and specifications by **fixture designation or specification paragraph number on an index tab**. One complete set of submittal data shall be manufacturer's original published material. **FAXED COPIES WILL NOT BE ACCEPTABLE.** Approval of materials will be based upon the manufacturer's

published ratings. Submit shop drawings and/or catalog data for the following material and equipment:

1. Waste Piping, Fittings and Couplings
2. Condensate Piping, Fittings and Couplings
3. Water Piping, Fittings and Equipment
4. Fuel Gas Piping, Fittings and Equipment
5. Roof Drainage Piping, Fittings and Couplings
6. Circulator Pumps
7. Sump Pump
8. Grease Interceptor
9. Oil Separator
10. Cleanouts and Access Doors
11. Valves
12. Insulation
13. Hangers
14. U. L. penetration systems
15. Pipe Markers
16. Fixtures
17. Coordination Drawings per Division 1.

- C. Approval of shop drawings and/or submittal data shall not relieve the Plumbing Contractor of the responsibility to comply with the requirements and intent of the plans and specifications with regard to dimensions, capacities, quality, quantity, performance characteristics, etc. If data submitted deviates from the contract documents, the Plumbing Contractor shall point out such deviations in writing and also state reasons for same. All similar items shall insofar as possible be one make and manufacturer.
- D. Where any special make, fixture or materials are specified by plate number, trademark or name, deliver to the building with original labels or other identification marks placed thereon by the manufacturer and do not remove until inspected and approved by the Architect. Similar and equal materials and equipment by other manufacturers will be acceptable, subject to approval.
- E. Failure to submit materials, equipment, fixtures, etc., in the time period specified above, the Architect shall assume that all items shall be installed as specified.

220004 WORKMANSHIP

- A. Layout:
1. Drawings indicate general locations of fixtures. Secure exact location from Architectural plans before proceeding with work.
 2. Furnish and install all necessary sleeves, inserts, bolts, etc., for concrete floor slabs, roof, walls, and partitions. Failure to install such items in time to avoid delaying the general contractor shall result in the Contractor doing all cutting and repairing at his own expense.
 3. Sleeves as here-in-after specified shall be installed on all through the floor piping above slab on grade except water closet rough-ins. Water closet rough-ins shall be cast in place. Core drilling of slabs shall be sealed with approved fire retardant caulking and sealed watertight.

4. All equipment shall be installed in accordance with manufacturer's written installation instructions.

B. Drainage, Waste and Vent Piping:

1. Grade all sanitary waste lines 2" and smaller 1/4" per foot.
2. Grade all sanitary waste lines 3" and larger 1/4" per foot, where possible, 1/8" per foot minimum.
3. Grade all condensate drain lines 1/8" per foot.
4. All underground piping shall be graded by the use of a laser beam alignment system.
5. All floor drains shall be set 1/2 inch below the room finished floor perimeter and the entire floor sloped to the floor drain.
6. Run all piping as directly as possible, avoiding unnecessary bends and turns so as not to interfere with proper installation of work of other contractors.
7. All PVC-DWV piping shall be protected by a cast iron sleeve under the following condition with a sleeve as follows:
 - a. Piping passing thru foundation walls: Sleeve shall extend 6 inches beyond wall footing on both sides.
 - b. Piping passing below a footing: Per Contract Drawings.
8. Provide removable caps for cleanouts with at least six threads engaged. Provide cleanouts at foot of waste and drainage stacks, all changes in direction of horizontal lines more than 135 degrees, in straight lines at intervals not exceeding 100-feet and anywhere additionally noted on the drawings.
9. Run all horizontal and vertical piping true and plumb to building structure and connect all piping with 'Y' branches and 1/8 or 1/16 bends.
10. Tapped tees and crosses will not be permitted. Tapped sanitary tees and crosses shall be used.
11. No soil, waste, or vent piping shall be covered or concealed, until tested and approved by the Architect.
12. Conceal all soil and vent piping. Vents shall be tied together as shown with minimum number of vents extending through roof. All vents extended through the roof shall be a minimum of 12" above roof level.
13. All PVC-DWV and PVC drainage lines shall be bedded per the manufacturer's recommendations and shall be maintained under a continuous head of 10-feet until after all concrete slabs are poured and/or all heavy equipment has been removed from the site. Contractor shall be responsible for the protection of the piping system at all times including freezing weather.

C. Water System:

1. Conceal water supply piping in walls, below floor or above ceiling except where exposed for connections to fixtures. Install and secure all piping as walls are built. Wedging of piping will not be permitted. All piping shall be isolated from mortar.
2. All water piping shall be routed with a minimum clearance of ten (10) feet from any electrical switchboards, panel boards or telephone backboards.
3. Arrange all pipes to freely drain through a ball valve when water is cut off. All branch valves shall be installed adjacent to the water piping main.
4. All supplies to fixtures shall have individual stop valves.

5. Provide water hammer shock arrestors as required to prevent water hammer. Arresters shall be A.S.S.E. Standards Number 1010 certified. Arresters shall be installed in accordance with manufacturer's published recommendations. Air chambers are not acceptable. Water hammer shock arrestors shall be as manufactured by Precision Plumbing Products, Inc. or approved equal by Zurn, Josam, J.R. Smith, or Sioux Chief.
6. All exposed piping to fixtures shall be chrome plated installed true and plumb.
7. Insulate all water piping inside the building as hereinafter specified.
8. All tees shall be installed such that the flow shall be straight thru the tee and/or out the side. Tees **shall not** be installed where the flow is into the side and out of both ends of the tee (bullhead tee). Bullhead tees installations are not acceptable and shall not be used.
9. Extend water lines to water mains where shown on the plans.
10. Terminate cold water line 5-feet outside building. Connection at this point will be by the General Contractor.

D. Fuel Gas System:

1. Gas piping shall be concealed in walls or above ceilings unless noted otherwise.
2. Gas piping shall be graded 1/4" per 15-feet towards drip legs. Drip legs shall be full size of the main and shall be 6 inches in length.
3. Gas piping encasement shall be graded to point where vented to atmosphere.
4. Gas piping shall be installed in accordance with North Carolina State Gas Code.

E. Roof Drainage Piping:

1. Roof drains shall be provided by the Plumbing Contractor and installed where shown on the architectural roof plan by the General Contractor. The Plumbing Contractor shall connect to these roof drains and install the collector and leader system as shown on the plans.
2. Grade all horizontal leaders with slopes as shown on the drawings.
3. All PVC-DWV and PVC drainage lines shall be maintained under a continuous head of 10 foot until after all concrete slabs are poured and/or all heavy equipment has been removed from the site.

F. Insulation:

1. All pipe insulation joints shall be sealed to maintain integrity of the vapor jacket and shall pass thru all sleeves unbroken except for fire stops.
2. Pipe insulation at all fire separations shall be butted tightly to the firewall or to the floor after fire stop material has been installed.

220005 CUTTING, PATCHING AND CHASING

- A. All cutting and patching shall be in accordance with the "General Conditions" of these specifications.

220006 EXCAVATION, TRENCHING AND BACKFILLING

- A. All excavation, trenching and backfilling shall be in accordance with Division 31 of these specifications.

220007 SEISMIC RESTRAINTS

- A. The Contractor shall be responsible for providing restraints to resist the earthquake effects on the plumbing system. The requirements for these restraints are found in Section 1613 of the North Carolina Building Code. All tables and references shall conform to the building's location. Restraints shall be per Seismic Design Category C.
- B. The Contractor shall refer to the latest edition of the "Seismic Restraints Manual Guidelines for Mechanical Systems" published by SMACNA for guidelines to determine the correct restraints for piping and conduit, etc. This manual refers to Seismic Hazard Level (SHL).
- C. The anchorage of the equipment and machinery for this project shall be an integral part of the design and specification of such equipment and machinery. Manufacturers of all equipment including pumps, hot water heaters, tanks, etc. shall provide anchorage details, isolators, seismic mounts and restraints, etc. necessary to comply with Section 1613 to the Contractor for installation. It shall be the Contractor's responsibility to provide and install the equipment, machinery, systems, and assemblies, etc. For this project that satisfies these requirements.
- D. Where seismic restraints are required, the Contractor shall provide restraints per details and instructions included in SMACNA's Seismic Restraints Manual. Contractor shall include shop drawings of the specific methods of seismic restraint to be used for this project before installation of piping and equipment.
- E. The Contractor shall retain the services of a Professional Engineer registered in the State of North Carolina to design seismic restraint elements required for this project. The engineer's computations, bearing his professional seal, shall accompany shop drawings that show Code compliance. Computations and shop drawings shall be submitted for review prior to the purchasing of materials, equipment, systems and assemblies.
- F. Internal seismic restraint elements of manufactured equipment shall be certified by a Professional Engineer retained by the manufacturer. Such certificate applies only to internal elements of the equipment. All equipment anchorage requirements shall be coordinated with the building structure and shall be compatible thereto. All such anchorage shall be reviewed by the project's structural engineer.
- G. The Professional Engineer retained by the Contractor for seismic restraint calculations, shall visit the job site upon completion of the seismic restraint installation. This engineer shall provide in writing verification of compliance with the approved seismic submittal. This verification shall bear the Engineer's professional seal. Job site inspections by other than this engineer are not acceptable.
- H. Review of the seismic design and shop drawings by the Engineer/Architect or his agent shall not relieve the Contractor of his responsibility to comply with the seismic or any other requirements of the North Carolina State Building Code.

220008 WASTE & VENT SYSTEMS

- A. Piping:
 - 1. Waste, grease waste and vent piping shall be schedule 40 PVC-DWV solid wall conforming to ASTM D-2665 and C.S. 272 with NSF seal.
- B. Fittings:
 - 1. Fittings for PVC-DWV piping shall be PVC-DWV fittings conforming to piping specifications.
- C. Joints:
 - 1. Joints for PVC-DWV piping shall be made using the piping manufacturer's approved solvent cement.
 - 2. Flashing of plumbing vents will be provided by the General Contractor.
- D. Grease Interceptor:
 - 1. Grease interceptor shall be polyethylene designed for direct burial, two built in manholes, two standard vent locations, open-top inlet diffuser to provide air relief, closed- top outlet dip tube to provide sewer gas trap, minimum 250 gallons of liquid holding capacity, Striem OS-100 or approved equal by Mifab or Green Turtle and shall be approved by CFPUA.
- E. Oil Separator:
 - 1. Oil Separator shall be polyethylene, gravity type with two manholes. Capacity shall be 165 gallons minimum. Oil Separator shall conform to CFPUA regulations, and shall be suitable for H2O loading. Oil Separator shall be Striem OS-100 or approved equal by MiFab or Town and Country Plastics.

220009 CONDENSATE DRAINAGE

- A. Piping:
 - 1. Condensate piping shall be Schedule 40 PVC-DWV solid wall, conforming to ASTM D-2665 and C.S. 272.
- B. Fittings:
 - 1. Fittings for PVC-DWV piping shall be PVC-DWV fittings conforming to piping specifications.
- C. Joints:
 - 1. Joints for PVC-DWV piping shall be made using manufacturer's approved solvent cement.

220010 HOT AND COLD WATER SYSTEMS

- A. Water Piping:
 - 1. Water piping 2-1/2" and smaller, below grade, shall be type 'K' soft copper conforming to ASTM B-88.

2. Water piping 3" and larger, below grade, shall be type 'K' hard copper conforming to ASTM B-88.
3. Water piping 4" and smaller above grade inside the building shall be Type 'L' hard copper conforming to ASTM B-88.

B. Fittings:

1. Fittings for copper piping shall be wrought copper, solder joint fittings conforming to ANSI B 16.22.
2. Fittings for copper piping 2" and smaller may be press fittings conforming to ASME B16.18 or ASME B16.22 and performance criteria of IAPMO PS 117.

C. Joints:

1. All copper piping joints, 1-1/4" and smaller shall be made using lead free solder with a minimum melting point of 410 degrees Fahrenheit.
2. All copper piping joints, 1-1/2" and larger shall be made using Phos-copper silver alloy material with a minimum melting point of 1000 degrees Fahrenheit.
3. Press fitting joints shall be made using the press fitting manufacturer's tools and per manufacturer's instructions. **Upon completion of the project, the press fitting manufacturer's tools used for installation shall be turned over to the Owner.**

D. Backflow Preventer:

1. Backflow preventer shall be lead-free double check valve design, high hazard, with strainer, test valves, gate valve on inlet and discharge, inlet and outlet pressure gauges, designed to meet AWWA C-510, ASSE 1015. Unit shall be size as shown on the drawings and be manufactured by Watts LF007S or approved equal by Wilkins, Febco, or Conbraco.

E. Expansion Tank:

1. Expansion tank shall be diaphragm design constructed of welded steel and shall bear the ASME and National Board Stamp for 150 pounds working pressure and 200° F. operating temperature. Fittings shall include test cocks, hose bibb drain and air control fitting. Tank and fittings shall be as manufactured by Amtrol, Bell and Gossett, Thrush or Taco.

F. Thermometers and Gauges:

1. Thermometers shall be metallic element type with 3" dial, Type 304 stainless steel case, accuracy range of 1%, black markings on white face, and designed for variable angle mounting. Thermometers range shall be such that the operating temperature shall be in the middle range for the dial. Thermometers shall be installed in a thermometer well and shall be Weiss Model 3VBM Series or approved equal by Omega or Tel-Tru Mfg. Co.
2. Pressure gauges shall be non-filled with 4" face, 1/4" NPT lower connection with operating range in middle portion of the dial, accuracy range of 1%, and black markings on white face. Pressure gauges shall be installed with lever handle gauge cocks. Pressure gauges shall be Weiss Model 4PG1 or approve equal by Omega or Tel-Tru Mfg. Co.

220011 FUEL GAS SYSTEM

A. Gas Piping:

1. Gas piping above grade and inside the building shall be standard weight schedule 40 black steel conforming to ASTM A-53.

B. Fittings:

1. Fittings for piping 2" and smaller above grade and inside building shall be malleable iron threaded fittings conforming to ASME B16.3 with threads conforming to ASME B1.20.1.
2. Fittings for piping 2-1/2" and larger above grade and inside the building shall be steel.

C. Joints:

1. Joints for threaded piping shall be made using pipe dope applied sparingly to the male thread of pipe. Pipe dope shall be resistant to actions of gas.
2. Joints for steel piping 2-1/2" and larger shall be welded.

D. Pressure Regulators:

1. Regulators shall have the minimum capacities as shown on the drawings with single stage pressure reduction. Regulators installed inside the building shall be of the limited venting design.
2. Regulators shall be listed as complying with ANSI Z21.80, and shall be equal to those as manufactured by Maxitrol, American Meter Company, or Invensys.

E. Gas Valves:

1. Gas valves shall be U.L. or AGA approved bronze construction, full port ball with threaded ends conforming to ASME B16.44. Valves located on 2 psi gas lines shall be labeled "2G".
2. Gas valves controlling each piece of equipment shall be full ported, bronze body, threaded ends, ball valve with gauge tapping.
3. Each valve shall be lubricated and turned during the installation to assure good working order. Plug valves shall be greased again after turning to aid the shut off. All valve boxes shall be encased in 18" square x 6" thick concrete pad at grade level.

F. Connections:

1. The Plumbing Contractor shall coordinate the rough-in connection for the mechanical equipment with the Mechanical Contractor. The Plumbing Contractor shall make the final connection to the gas train with an approved AGA flexible connector.

220012 ROOF DRAINAGE SYSTEM

A. Piping:

1. Roof drain leaders above grade shall be hubless cast iron piping conforming to C.I.S.P.I. Standards 301 and shall carry country of origin, manufacturer's name or manufacturer's registered trade-mark.
2. Roof drain leaders below grade or slab on grade shall be Schedule 40 PVC-DWV solid wall, conforming to ASTM D-2665.

B. Fittings:

1. Fittings for cast iron roof drain leaders shall be the sanitary drainage pattern cast iron conforming to ASTM A-74 and shall be marked with the Cast Iron Soil Pipe Institute symbol cast into the fitting.
2. Fittings for roof drain leaders shall be Schedule 40 PVC-DWV conforming to ASTM D-2665.

C. Joints:

1. Joints for hubless cast iron piping shall be made using neoprene gasket and cast iron clamping band with stainless steel bolts torqued to manufacturer's specifications. Clamps shall be as manufactured by MG Piping Products Company or approved equal.
2. Joints for PVC-DWV piping shall be made using manufacturer's approved solvent cement.

D. Drains:

1. Primary roof drains shall be large sump body coated cast iron drains with galvanized cast iron domes, adjustable extension, combination flashing device/gravel guard, static extension and top set deck plate. Drains shall be Zurn ZC-100-DP-E or approved equal by Josam, J. R Smith, Wade or Watts. Height of static extension shall be as shown on architectural drawings. No hub outlet shall be sized as shown on the drawings.
2. Primary terrace drains shall be large sump body coated cast iron drains with nominal 12 inch square galvanized cast iron top, combination flashing device/gravel guard, static extension if required and top set deck plate. Drains shall be Zurn ZC-154-DP-E or approved equal by Josam, J. R Smith, Wade or Watts. Height of static extension shall be as shown on architectural drawings. No hub outlet shall be sized as shown on the drawings.

220013 HOT WATER CIRCULATOR

- A. Circulator shall have capacity as shown on drawings and shall be specifically designed for domestic hot water service.
- B. Circulator shall have lead-free bronze body and flanges with lead-free impeller; circulator motor shall be rubber mounted and shall be equipped with overload protection. Circulator shall be direct connected to motor. Circulator shall be Taco, B&G, or Grundfos with capacity as noted on the drawings.

- C. Circulator shall be supported by appropriate hangers to avoid piping strain. Circulators shall be mounted horizontally.

220014 SUMP PUMP

- A. The Contractor shall furnish and install submersible sump pump with non-clog vortex impeller, cast iron base, float switches, rust resistant steel shaft, and power/control cords to plug into standard duplex receptacle.
- B. Sump pump shall have capacity of 50-GPM at a 20-foot total dynamic head 1/2 HP, 120-volt single phase motor with internal overload and thermal protection. Pump shall be complete with NEMA 4X weather tight corrosion resistant fiberglass enclosure. Control system shall be complete with audio alarm with silencing switch, red light alarm, high level alarm, manual reset, remote monitoring circuit. Complete systems shall be Stancor, Zoeller, or Grundfos.
- C. Sump for Pump will be furnished and installed by the General Contractor.
- D. Pump shall be started by the manufacturer's factory representative.

220015 SUMP PUMP DISCHARGE/WASTE OIL PIPING

- A. Piping:
 - 1. Piping shall be Schedule 40 PVC-DWV solid wall, conforming to ASTM D-2665.
- B. Fittings:
 - 1. Fittings for shall be of the sanitary drainage pattern and conforming to piping specification.
- C. Joints:
 - 1. Joints for PVC-DWV piping shall be made using manufacturer's approved solvent cement.

220016 CLEANOUTS AND ACCESS DOORS

- A. Cleanouts shall be the same diameter as the pipe they are connected to. If the pipe is greater than 4" in diameter, the cleanout shall be 4".
- B. Cleanouts installed in walls or pipe chases shall be installed using cleanout tee with cast bronze slotted plug, stainless steel cover with vandalproof securing screw. Cleanouts shall be Zurn ZS-1468, Josam 58600-PLG, or J. R. Smith 4472.
- C. Cleanouts installed in floors and walks shall have adjustable cast iron body with cast brass plug, lead seal and round nickel bronze top with watertight gasketed cover. Cleanouts shall be Zurn ZN-1400, or approved equal by Josam or J. R. Smith.
- D. Cleanouts installed above ceiling, where permitted by authority having jurisdiction, shall be a pipe cap installed using a no-hub band and clamp.

- E. Cleanouts installed outside the building and flush with grade shall be installed flush with 24" x 24" x 6" thick concrete pad. Cleanouts plugs shall be ABS with recessed head. Cleanouts shall be Josam 57000-X-LT, Zurn Z-1403-BP-NL, or J. R. Smith 4293 Series.
- F. Cleanouts indicated on the Contract Drawings as "HDFCO", shall have adjustable cast iron body with cast brass plug, lead seal and heavy-duty veneer nickel bronze top with watertight gasketed cover. Cleanouts shall be installed flush with finished floor. Cleanouts shall be Zurn ZN-1400-HD, or approved equal by Josam or J. R. Smith.
- G. The Contractor shall provide access doors in accordance with Division 08. Access doors shall be provided for all valves, shock arrestors, and water heaters located behind hard ceilings and in walls to provide access. Ceiling access doors shall be a minimum of 24" x 24".

220017 VALVES

- A. Valves shall be installed at all points noted on the plans by standard symbols or as required by best general practice for proper control and operation of the system. All valves shall be identified with 1" diameter, 19 gauge, polished brass identification tags with a number and valve service indicated. Provide a valve chart listing all valves with size and service framed and mounted under glass in the main mechanical room. Provide a self-sticking 1/2" diameter dot on lay-in ceiling grid at all valve locations. Red dot for domestic hot water supply and return, Blue for cold water.
- B. Check valves 2 inches and smaller shall be Class 125, lead free design cast bronze body with threaded ends.
- C. Domestic cold and hot water system valves 1-1/4 inch and smaller shall be lead free design cast bronze body, full ported, soldered end ball valves rated for Class 150, 200 WOG service.
- D. Domestic cold and hot water system valves 1-1/2 inch and 2 inch shall be lead free design cast bronze body, full ported, threaded end ball valves rated for Class 150, 200 WOG service. Valves shall be provided with stem extensions for insulation thickness specified.
- E. Domestic cold and hot water system valves 2-1/2 inch and larger shall be flanged end, iron body ball valves rated for Class 150, 200 WOG service. Valves shall be provided with stem extensions for insulation thickness specified.

220018 PIPE INSULATION

- A. All plumbing pipe insulation systems shall be installed as a subcontract to the Plumbing contract. All plumbing pipe insulation systems, including jacketing, coverings, adhesives when used, shall have a flame spread rating not exceeding twenty-five (25) and a smoke development rating not exceeding fifty (50) when the insulation assembly is tested as a composite. Fibrous glass pipe insulation shall be pre-molded with a thermal conductivity of 0.24BTU/in/hr/ft² at 100°F.

1. Insulate all cold water piping above grade with 1" thick pre-molded fibrous glass pipe insulation with self-sealing fire retardant vapor barrier jacket.
 2. Insulate all hot water piping, 1-1/2" and smaller, above grade with 1" thick pre-molded fibrous glass pipe insulation with self-sealing fire retardant jacket.
 3. Insulate all copper water piping below grade or slab on grade with 1/2" thick pre-molded closed cellular plastic foam pipe insulation.
 4. Insulate all hot water return piping with 1" thick fibrous pre-molded glass pipe insulation with self-sealing fire retardant jacket.
 5. All drain bodies receiving rain water shall be insulated with 1" thick insulating cement insulation.
 6. All roof drain leaders, horizontal and vertical, above slab on grade shall be insulated with 1" thick pre-molded fibrous glass pipe insulation with self-sealing fire retardant vapor barrier jacket.
 7. All P-Traps indicated on the Contract Drawings to be insulated shall be insulated with 1" thick pre-molded fibrous glass pipe insulation with self-sealing fire retardant vapor barrier jacket
 8. Rigid pipe insulation inserts shall be provided for all insulated piping 2" and larger.
 9. All condensate drainage piping, horizontal and vertical, above slab on grade serving air conditioning condensate shall be insulated with 1" thick pre-molded fibrous glass pipe insulation with self-sealing fire retardant vapor barrier. Condensate P-traps shall be insulated with 1" thick insulating cement insulation.
- B. Exposed pre-molded pipe insulation in finished areas and mechanical rooms shall be finished with factory jacket neatly pasted in place and left ready for painting as specified hereinafter.
- C. All pipe insulation for pipe fittings shall be pre-molded to fit fittings and shall be enclosed under pre-molded PVC fitting jacket.
- D. Plumbing piping located in CMU walls shall be insulated with closed cellular foam insulation with thicknesses as specified above. Foam insulation thermal properties shall match or exceed the specified thermal insulation properties for the intended usage. Insulation shall be secured with insulation manufacturer's approved tape.
- E. Contractor **may request** that closed cellular foam insulation be used on insulated piping when the building structure is not "dried in" to protect fibrous glass insulation from getting wet. Foam insulation thermal properties shall match or exceed the specified thermal insulation properties for the intended usage. Insulation shall be secured with 16 gauge copper wire at 16 inch centers.

220019 HANGERS

- A. Hangers for vertical piping shall be the Riser Clamp design, stainless steel, and shall conform to MSS SP-58, Types 1 through 58.
- B. Hangers for horizontal piping shall be the Clevis type, stainless steel and shall conform to MSS SP-58, Types 1 through 58.
- C. **Hangers for insulated piping shall extend around the insulation.** Provide 16 gage galvanized steel insulation protection saddles 12" long at each hanger on all insulated

lines. At the contractor's option, hangers for insulated piping may be Michigan Hangers Model 4031 or 4041. Insulation Shields shall cover lower 180 degrees of pipe in the case of clevis hangers, and entire circumference of pipe in the case of trapeze hangers or clamps.

- D. Hangers shall be spaced per the NC State Plumbing Code in accordance with the piping material.
- E. A hanger shall be provided within one (1) foot of each bend in horizontal piping. Vertical piping shall be supported at each floor or at intervals not exceeding ten (10) feet. Support cast iron pipe to each joint.
- F. For piping 4" in diameter and larger, rigid support sway bracing shall be provided at changes in direction greater than 45 degrees.
- G. Hangers shall be fastened by means of threaded rods to steel beam clamps, center of bar joist, center of trusses, etc. All hangers shall permit adequate adjustment after erection while still supporting the load. All hanger rods attached to bar joist and trusses shall be install between bottom or top cords of the structural member. Structural members to span from building structure to structure shall be provided by the Contractor.
- H. Hangers SHALL NOT be fastened to joist bridging or roof deck.
- I. Hangers shall only be hung with drilling into the slab with "drop-in" hangers with the approval of the Structural Engineer of record and the Mechanical Engineer of record with complete dead and operating load information provided for each location. Loading information shall be provided by the Plumbing Contractor.
- J. Piping supported on a trapeze hanger shall be secured to the trapeze hanger by means of a pipe clamp around the pipe insulation and insulation saddle. Bare piping shall be secured by a pipe clamp and isolated by an isolation cushion.
- K. Piping supported from the floor shall be supported using a base plate securely anchored to the floor and be equipped with a pipe riser. Riser shall be a minimum size of one inch. Horizontal piping above the floor shall be anchored and rest on a manufactured saddle. Piping shall be secured to each saddle as approved by the Engineer.

220020 PIPE SLEEVES, PLATES, ESCUTCHEONS, ETC.

- A. Pipe sleeves shall be standard weight schedule 40 black steel above slab on grade or cast iron below slab on grade. All sleeves shall be equal to construction thickness except that pipe sleeves passing through floors, other than slab on grade, shall extend 3/4" above the finished floor. Pipe sleeve sizes shall be sized two pipe sizes larger than piping passing thru the sleeve.
- B. Piping thru non-fire rated walls, floors above slab on grade or ceilings, piping passing through foundation walls, and piping installed below structural footings shall have sleeves installed concentric and centered on pipe. Ream all sleeves to prevent cutting of piping. The Contractor shall furnish shop drawings to the general contractor and the

Architect showing location, dimensions, and sizes of holes required. Sleeves on piping passing through foundation walls shall extend 6" beyond wall footing on both sides. Sleeves on piping installed below structural footings shall extend beyond footing as indicated on contract drawings.

- C. Install escutcheons snug against room finish on all exposed pipe passing through walls, floors above slab on grade or ceilings. Use cup type escutcheons at floors where sleeves extend above finished floors. Escutcheons shall be chrome plated steel with spring clip.
- D. Sleeves for insulated piping shall be large enough to allow the insulation to pass thru sleeve unbroken.
- E. Core drill openings for all floor openings may be utilized in lieu of sleeved openings. All openings shall be sized two pipe sizes larger than pipe passing thru the opening. All cored openings shall be fireproofed as required and shall be made water tight.
- F. All penetrations in rated floors, firewalls and any other rated separations shall be protected using a through-penetration firestopping method with an "F" rating equivalent to the rating of the membrane being penetrated for particular piping materials used and membrane construction type. Floor penetrations shall additionally have a "T" rating equivalent to the rating of the floor being penetrated. Through-penetration firestop systems shall be installed and tested in accordance with ASTM E814 or UL 1479 with a minimum positive pressure differential 0.01 inch w.g. All openings through horizontal fire separations shall be protected by Metacaulk U.L. Systems or approved U.L. listed system by other manufacturers.
- G. All openings through floors and vertical fire separations shall be protected by combination water seal and fire stops as manufactured by HoldRite, or approved equal by Proset, Metacaulk, or 3M.

220021 PLUMBING SYSTEM IDENTIFICATION

- A. All piping in the building shall be identified by snap-on pipe markers or secured with two zip ties. Markers shall have ANSI colored letters at ANSI height on ANSI colored background with flow arrows and shall be located at 10' on center along pipeline, at each tee branch and at each floor/wall penetration, both sides. A pipe marker shall be located adjacent to each valve. Pipe identification markers shall comply with ANSI A13.1 and be Custom MS-790 as manufactured by Marketing Service Incorporated or approved equal Steton, Emed or DuraLabel. Stenciling of piping and/or insulation is not acceptable. Wording on markers shall be as follows where more stringent than ANSI Standards:
 - 1. Cold Water
 - 2. Hot Water
 - 3. Hot Water Return
 - 4. Waste
 - 5. Vent
 - 6. Fuel Gas (with pressure noted)
 - 7. Condensate
 - 8. Roof drain

- B. Engraved plastic laminate signs for listed plumbing equipment shall be 1/16 inch thick and be secured with self-tapping stainless steel screws. Plastic laminate face color shall be red for all emergency applications and black for all other uses. Background color shall be white. Signage for all equipment, etc., shall show equipment or service identification, capacity, final date of acceptance for equipment item and warranty information. Signage shall be provided for the following items:
1. Water Heaters
 2. Sump pump
 3. Circulator pumps

220022 PROTECTION OF WORK AND EQUIPMENT

- A. It is imperative that waste and vent lines not be filled with concrete, concrete grindings, sand, gravel, or other foreign matter. Under no circumstances shall any line be left open while the Contractor's workers are not on the job site.
- B. Plug each opening of waste and vent lines the same day it is installed with test plug securely held in place.
- C. All floor drains and hub drains shall be covered immediately after installation.
- D. The Contractor shall be responsible for all work damaged by him/her. Any plumbing work damaged by any other contractor shall be replaced by the Contractor and placed in perfect working condition without extra cost to the Owner. All fixtures and fittings shall be adequately protected before, during and after installation.
- E. The Contractor shall be responsible for all plumbing fixtures at time of final inspection. Any broken fixtures will be replaced by the Contractor at no cost to the owner regardless of by whom the fixture was broken.

220023 TESTING

- A. The Contractor shall notify the Engineer forty-eight (48) hours in advance of all tests. The Contractor shall make all necessary preliminary tests to insure a tight system. Any joint found to leak under test shall be broken, cleaned and remade.
- B. All tests shall be applied before any work is concealed or covered in any manner.
- C. All sanitary waste, grease waste, vent and condensate drainage piping shall be tested in the following manner: Plug all openings and fill entire waste and vent system to overflow with water and sustain a constant level for a minimum period of three hours. All portions of the floor system shall be tested under a minimum of a 10-foot head including roof vent terminal.
- D. All water piping, hot and cold shall be made tight under a hydrostatic test pressure of 150-lbs. per square inch and maintained without pressure loss for a minimum of four (4) hours. No caulking of joints will be permitted. Any joint found to leak under this test shall be broken, remade and a new test applied.
- E. All backflow preventers shall be tested and certified by an approved and licensed backflow prevention company.

- F. All fuel gas piping shall be tested by applying an air pressure of 100-lbs. per square inch and shall be maintained for minimum of eight (8) hours. Air receivers shall be charged with peppermint for odor test and any indication of leakage will be checked by applying a soap and water solution at each joint to determine leaking joint. Test shall be conducted using an eight inch pressure-temperature recorder with a pressure range of 0-150-psi with a 24 hour recording time. Pressure measuring elements shall be heat treated to prevent hysteresis-related inaccuracies. The original chart with copies shall be included in the "Owners and Operating Manuals.
- G. The roof drain piping system shall be tested in the following manner: Plug pipe outlet and fill entire under floor system with water under a 10-foot head above finished floor and sustain a constant level for a minimum period of three (3) hours. All piping above the lowest floor level shall be tested from a test tee installed at that level with the entire system filled with water into drain body and sustain the constant level for a period of three (3) hours.
- H. The Contractor shall furnish all necessary equipment, materials and labor to perform the above-specified tests.

220024 STERILIZATION

- A. All new water piping shall be charged with a chlorine solution containing not less than 50-ppm available chlorine. The solution shall remain in the piping for a minimum period of 6 hours, during which time valves shall be opened and closed to permit a small flow of the solution. At the end of the six (6) hours, the solution shall be tested and must contain a residual of at least 5 to 10 ppm chlorine. The system shall then be drained and flushed to provide satisfactory potable water before final connection is made to the existing distribution system.
- B. The Contractor shall contract with an independent Testing Laboratory for a certification letter that the system sterilization meets or exceeds standards for potable water.

220025 PLACING IN SERVICE

- A. Upon completion of the entire system installation, the entire system and all equipment shall be tested by actual operation to provide that it will function as intended.
- B. The Contractor shall flush all waste piping prior to final connection to existing system, to ensure that no foreign materials are in these lines, and that a continuous flow of water and waste can be affected.
- C. The Contractor shall flush all water piping prior to the connection of flush valves, mixing valves, and faucet aerators to provide a clean and operational water system.
- D. The Contractor shall place the entire system in a satisfactory operating condition and shall furnish all assistance and instructions required by the Owner's representative during initial operating period. The Contractor shall acquaint the Owner's representative with the special parts required for the operation of the flush valves furnished and installed on the project.

- E. It is the Contractor's responsibility to turn over to the owner all fixtures and floor drains in a clean condition.

220026 PAINTING

- A. The Contractor should note that plumbing piping may be exposed in various areas. The contractor should specifically note that all exposed cast iron piping be uncoated.
- B. All exposed plumbing pipe and plumbing pipe insulation in areas other than mechanical rooms shall be left clean and free from oil ready for painting by the General Contractor. All finished painting will be by the General Contractor with colors to match the surrounding areas.
- C. The Plumbing Contractor shall paint all plumbing insulation, exposed plumbing piping, etc., in Mechanical Equipment Rooms. Insulation to be painted with two (2) coats of glue sizing and two coats lead free enamel paint. Exposed piping and pipe hangers shall be painted flat black. Paint colors shall be as follows:

<u>SERVICE</u>	<u>Benjamin Moore</u>		<u>Sherwin Williams</u>	<u>Devoe</u>
	<u>Number</u>	<u>Color</u>		
Cold water		Blue	Blue	Blue
Hot water	1330	My Valentine	SW1581	3W4-6
Hot water return	2081-50	Pink Ruffle	SW1575	5W3-3

- D. All exposed gas piping exposed to the exterior and exposed in mechanical rooms shall be cleaned of all rust and painted with one (1) coat of rust inhibitor primer and two (2) coats of oil base Yellow paint.
- E. All plumbing equipment pads shall be painted yellow.

220027 ELECTRICAL WIRING

- A. The Electrical Contractor shall furnish and install all disconnects and motor starters and circuitry. Plumbing Contractor shall make all final electrical connections to equipment provided under Division 22. See Electrical Drawings.
1. EXCEPTION: Plumbing Contractor shall provide Aquastat(s) as indicated on Contract Drawings and in "CONTROLS" section of Division 22 specifications. The Plumbing Contractor shall be responsible for Aquastat wiring connections.

220028 CONTROLS

- A. General:
1. Furnish and install an electric control system to fulfill the intent of the drawings and specifications. The system shall include all necessary labor, materials, electrical wiring and devices for a complete installed control system.
 2. The Plumbing Contractor shall provide a 120-volt, 24-hour, 7-day programmable time clock, and wire the time clock to the hot water circulation pump. Time clock shall be located in the same room as the circulation pump.
 3. All electric wiring in connection with the temperature controls and all interlock wiring shall be furnished under this section of the specifications. The wiring shall

be installed by licensed electricians employed by Contractor in strict accordance with all local, State, and National Codes. All control and interlock wiring whether line or low voltage shall be run in EMT conduit or as specified under the electrical section of these specifications. Installation of all concealed conduit shall be coordinated with contractor for general construction so it may be installed before slabs are poured or walls are erected.

4. The control diagrams indicated on the drawings and specified herein show the intended sequences of operation of the various control systems and shall be followed as closely as practicable.

B. Temperature Sensing Devices:

1. Strap-on Aquastat shall have an adjustable range and be mounted directly on the building hot water recirculating line. Aquastat shall be set to 135°F.
2. Each water heater shall be equipped with an integral adjustable thermostat.

C. Sequence of Operation:

1. The programmable time clock shall energize the power circuit to the circulator pump wiring circuit.

D. Instructions and Diagrams:

1. The Contractor shall provide to the owner a complete instruction manual covering the function and operation of all control components. The manual shall also contain a schematic drawing of each control system properly marked and keyed with the equipment list to identify each item of control equipment.
2. The Contractor shall also provide a complete schematic control diagram framed under glass and mounted on the wall in the equipment room.

220029 OPERATING AND MAINTENANCE MANUAL

- A. All operation and maintenance manuals **shall** be delivered by the Contractor to the Owner thru the Architect. The manuals **shall** be installed in 3-ring hard cover heavy duty notebooks with the name of the project and the words "**Operation and Maintenance Manual**" permanently affixed to the **cover** and **spine**. All items for the project shall be separated by identification tabs correlated to the index. The manuals **shall** contain the following items as a minimum:

1. Index and page number.
2. Certificate of substantial completion.
3. A summary sheet of warranties with dates noted and a copy of all warranties.
4. List of subcontractors and suppliers with names, addresses, and phone numbers.
5. Water Line test data for sterilization.
6. Backflow preventer certificate of operation.
7. Complete start-up, operation, and shutdown procedures for each system including sequence of events, locations of switches, emergency procedures, and any other critical items
8. Lubrication schedules and types of lubricants.
9. Complete set of current shop drawings and equipment description showing all capacities and other operation conditions.
10. Equipment summary showing all capacities and ratings (HP, KW, etc.).

11. Operation manuals, installation manuals, and parts list for all installed equipment.
12. All submittal data indexed with tabs and shop drawings.

- B. One copy shall be manufacturer's original published literature with manufacturer's name on all items. **FAXED COPIES WILL NOT BE ACCEPTABLE.**

220030 AS BUILT DRAWINGS

- A. The General Contractor and Plumbing Contractor, shall maintain "during the course of the work" a set of drawings marked up to show the work as installed, including dimensions to and elevations of buried work. Both Contractors shall initial and date all changes to the contract drawings. The Architectural Observer may check this set of documents monthly for compliance. Upon completion of the work, return this set of drawings to the Architect.

220031 FIXTURES

- A. All exposed piping and metal parts shall be chrome plated. Slip joints will not be permitted except on fixture side of trap. Rigid supplies are specified for fixtures and it is intended that they be installed true and plumb from fixture to wall rough in. Connections for water closets shall be made by use of flanges compatible to waste piping materials and verminproofed wax gaskets.
- B. **MANUFACTURER'S MODEL NUMBERS ARE PROVIDED FOR GENERAL INFORMATION ONLY.** Description of product shall take precedence over model numbers.
- C. All water closets shall flush properly when flushing with 25 PSIG at the flush valve.
- D. All floors drains, floor sinks, and shower drains shall have a deep seal cast iron P-trap installed below floor as a separate item. Joint connection shall be compatible to piping system.
- E. All floor-mounted water closets shall be set and grouted with white grout between floor and closet base.
- F. All wall-hung fixtures shall be sealed between wall and fixture with white "G.E. Silicone Seal" caulking.
- G. All counter mounted fixture rims shall be sealed with clear "G.E. Silicone Seal" caulking.

STAGE BUILDING

WC-1 **WATER CLOSET:** (Adult ADA) See architectural drawings for bowl, flush valve, and seat specifications. These items are to be provided and installed by Division 22. Contractor should note flush valve rough-in height as shown on the drawings. Flush valve handle shall be roughed in and mounted to the wide side of the toilet stall.

- U-1 URINAL: (ADA) See architectural drawings for bowl and flush valve specifications. These items are to be provided and installed by Division 22. Chair carrier with chrome plated cap nuts, Zurn Z-1222, or approved equal by J.R. Smith or Watts. Lip shall be mounted at height as shown on the drawings.
- U-1 URINAL: (Standard) See architectural drawings for bowl and flush valve specifications. These items are to be provided and installed by Division 22. Chair carrier with chrome plated cap nuts, Zurn Z-1222, or approved equal by J.R. Smith or Watts. Lip shall be mounted at height as shown on the drawings.
- L-1 LAVATORY: (ADA) See architectural drawings for bowl and faucet specifications. These items are to be provided and installed by Division 22. Thermostatic lead free mixing valve with locking set point, 3/8" inlet check stops, 3/8" outlet, shall be installed under the lavatory to supply 110 F tempered water to the faucet. Mixing valve shall conform to ASSE 1070 or CSA B125.3 and shall be Watts Model LFUSG-B or approved equal by Conbraco or Heatguard. A bronze lead free body strainer with stainless steel strainer shall be installed between the stop and the mixing valve. Chrome plated lead free angle stops with loose key handle and 1/2" chrome plated nipple to wall and escutcheon with set screw shall be McGuire or approved equal by Zurn or Brasscraft. Stainless steel braided flexible supplies shall be as manufactured by McGuire or approved equal by Brass Craft, Watts. Chrome plated cast brass strainer with open grid, overflow openings, cast brass locknut and 1-1/4" 17 gauge tailpiece shall be McGuire, Zurn, or Engineered Brass Company. 1-1/4" by 1-1/2" chrome plated adjustable cast brass P-trap with 1-1/4" slip in inlet, cleanout, ground joint, 1-1/2" I.P.S. outlet, shall be McGuire, Zurn, or Engineered Brass Company. 1-1/2" chrome plated nipple to wall with escutcheon and setscrew shall be McGuire, Zurn, or Engineered Brass Company. Chair carrier with floor anchor plate, upright supports, and bearing plate shall be Zurn Model Z-1224, J. R. Smith Model 0800, or approved equal by Watts. Lavatory shall be mounted at height as shown on the drawings. Lavatory supplies and trap shall be protected by A.D.A. approved premolded insulation assembly as manufactured by Truebro, McGuire or Mainline.
- L-2 LAVATORY: (Adult Standard) See architectural drawings for bowl and faucet specifications. These items are to be provided and installed by Division 22. Thermostatic lead free mixing valve with locking set point, 3/8" inlet check stops, 3/8" outlet, shall be installed under the lavatory to supply 110 F tempered water to the faucet. Mixing valve shall conform to ASSE 1070 or CSA B125.3 and shall be Watts Model LFUSG-B or approved equal by Conbraco or Heatguard. A bronze lead free body strainer with stainless steel strainer shall be installed between the stop and the mixing valve. Chrome plated lead free angle stops with loose key handle and 1/2" chrome plated nipple to wall and escutcheon with set screw shall be McGuire or approved equal by Zurn or Brasscraft. Stainless steel braided flexible supplies shall be as manufactured by McGuire or approved equal by Brass Craft, Watts. Chrome plated cast brass strainer with open grid, overflow openings, cast brass locknut and 1-1/4" 17 gauge tailpiece shall be McGuire, Zurn, or Engineered Brass Company. 1-1/4" by 1-1/2" chrome plated adjustable cast

brass P-trap with 1-1/4" slip in inlet, cleanout, ground joint, 1-1/2" I.P.S. outlet, shall be McGuire, Zurn, or Engineered Brass Company. 1-1/2" chrome plated nipple to wall with escutcheon and setscrew shall be McGuire, Zurn, or Engineered Brass Company. Chair carrier with floor anchor plate, upright supports, and bearing plate shall be Zurn Model Z-1224, J. R. Smith Model 0800, or approved equal by Watts. Lavatory shall be mounted at height as shown on the drawings. Lavatory supplies and trap shall be protected by A.D.A. approved premolded insulation assembly as manufactured by Truebro, McGuire or Mainline.

L-3 LAVATORY: (ADA) See architectural drawings for bowl and faucet specifications. These items are to be provided and installed by Division 22. Thermostatic lead free mixing valve with locking set point, 3/8" inlet check stops, 3/8" outlet, shall be installed under the lavatory to supply 110 F tempered water to the faucet. Mixing valve shall conform to ASSE 1070 or CSA B125.3 and shall be Watts Model LFUSG-B or approved equal by Conbraco or Heatguard. A bronze lead free body strainer with stainless steel strainer shall be installed between the stop and the mixing valve. Chrome plated lead free angle stops with loose key handle and 1/2" chrome plated nipple to wall and escutcheon with set screw shall be McGuire or approved equal by Zurn or Brasscraft. Stainless steel braided flexible supplies shall be as manufactured by McGuire or approved equal by Brass Craft, Watts. Chrome plated cast brass strainer with open grid, overflow openings, cast brass locknut and 1-1/4" 17 gauge tailpiece shall be McGuire, Zurn, or Engineered Brass Company. 1-1/4" by 1-1/2" chrome plated adjustable cast brass P-trap with 1-1/4" slip in inlet, cleanout, ground joint, 1-1/2" I.P.S. outlet, shall be McGuire, Zurn, or Engineered Brass Company. 1-1/2" chrome plated nipple to wall with escutcheon and setscrew shall be McGuire, Zurn, or Engineered Brass Company. Chair carrier with floor anchor plate, upright supports, and bearing plate shall be Zurn Model Z-1224, J. R. Smith Model 0800, or approved equal by Watts. Lavatory shall be mounted at height as shown on the drawings. Lavatory supplies and trap shall be protected by A.D.A. approved premolded insulation assembly as manufactured by Truebro, McGuire or Mainline.

L-4 COUNTER LAVATORY: See architectural drawings for bowl and faucet specifications. These items are to be provided and installed by Division 22. Thermostatic lead free mixing valve with locking set point, 3/8" inlet check stops, 3/8" outlet, shall be installed under the lavatory to supply 110 F tempered water to the faucet. Mixing valve shall conform to ASSE 1070 or CSA B125.3 and shall be Watts Model LFUSG-B or approved equal by Conbraco or Heatguard. A bronze lead free body strainer with stainless steel strainer shall be installed between the stop and the mixing valve. 1/2" sweat x 1/2" compression sink supply stops shall be equipped with 5" extension, wheel handle ball valve angle stops shall be McGuire, Zurn, or Brasscraft. 1-1/2" x 1-1/2" chrome plated adjustable cast brass P-trap with 1-1/2" slip joint inlet, cleanout, and 1-1/2" 17-gauge tube outlet shall be McGuire, Zurn, or Kohler. Install cast brass escutcheons with setscrew on all piping entering base cabinet. Supplies and trap shall be protected by A.D.A. approved premolded insulation assembly as manufactured by Truebro, McGuire or Mainline.

- SK-1 STORAGE ROOM SINK: See architectural drawings for bowl and faucet specifications. These items are to be provided and installed by Division 22. 1-1/2" x 1-1/2" chrome plated adjustable cast brass P-trap with 1-1/2" slip joint inlet, cleanout, ground joint, 1-1/2" I.P.S. outlet shall be McGuire No. 8089C, Zurn Z8712-PC-B, or K-8996. Sink supplies shall be installed using 1/2" type 'L' hard copper equipped with ball valve stops. Install chrome plated cast brass escutcheons on all piping leaving the wall.
- SK-2 COUNTERTOP SINK: (Double compartment) See architectural drawings for bowl and faucet specifications. These items are to be provided and installed by Division 22. 1/2" sweat x 1/2" compression sink supply stops shall be equipped with 5" extension, wheel handle ball valve angle stops shall be McGuire, Zurn, or Brasscraft. 1-1/2" x 1-1/2" chrome plated adjustable cast brass P-trap with 1-1/2" slip joint inlet, cleanout, and 1-1/2" 17-gauge tube outlet shall be McGuire, Zurn, or Kohler. Install cast brass escutcheons with setscrew on all piping entering base cabinet. Supplies and trap shall be protected by A.D.A. approved premolded insulation assembly as manufactured by Truebro, McGuire or Mainline.
- SH-1 SHOWER: (Adult ADA) ADA shower stall will be constructed by the General Contractor. Shower drain with cast iron body, 2" hub outlet, 5" square nickel bronze heelproof top, vandal resistant securing screws, Zurn ZN-415S-VP-Y, or approved equal by Josam or J. R. Smith. See architectural drawings for shower head, shower valve, and diverter valve specifications. Showerheads and controls shall be mounted as shown on the drawings.
- SH-2 SHOWER: (Adult Standard) Shower stall will be constructed by the General Contractor. Shower drain with cast iron body, 2" hub outlet, 5" square nickel bronze heelproof top, vandal resistant securing screws, Zurn ZN-415S-VP-Y, or approved equal by Josam or J. R. Smith. See architectural drawings for shower head, shower valve, and diverter valve specifications. Showerhead and controls shall be mounted as shown on the drawings.
- HB-1 HOSE BIBB: Wall mounted, polished chrome plated brass with 3/4" vacuum breaker hose end, locking shield, tee handle, 1/2" inlet wall flange, Woodford Model 26P-1/2, Mifab MHY-9240, T & S Brass B-0702/B-972 or Preir C-257CP.75.
- HB-2 HOSE BIBB IN BOX: Rough brass hose bibb with wheel handle, 3/4" vacuum breaker outlet, 1/2" inlet, cast brass or 304 stainless steel wall box, hinged door, loose key door lock, chrome plated or stainless steel exposed finish, Woodford Model B26-1/2-CH, Mifab MHY-95-49 or Metcraft Model 182.
- HB-3 WALL HYDRANT IN BOX: Non-freeze type with 3/4" copper inlet, 3/4" double check or vacuum breaker hose end, removable key handle, self draining, for wall thickness as required, Woodford Model B67, Zurn Model Z-1320-CXL or approved equal by Josam.

- FD-1 FLOOR DRAIN: Cast iron body drain with 4" outlet to match piping system, 6" square nickel bronze heelproof top, vandal resistant securing screws with flashing device, Zurn ZN415S-VP, or approved equal by Josam, J. R. Smith, Wade, or Watts. Install 4" in-line floor drain trap seal, ABS plastic housing with EPDM rubber diaphragm and soft rubber sealing gasket, conforming to ASSE 1072 as a separate item.
- FD-2 FLOOR DRAIN: Cast iron body drain with 2" outlet to match piping system, 6" square nickel bronze heelproof top, vandal resistant securing screws with flashing device, Zurn ZN415S-VP, or approved equal by Josam, J. R. Smith, Wade, or Watts. Install 2" in-line floor drain trap seal, ABS plastic housing with EPDM rubber diaphragm and soft rubber sealing gasket, conforming to ASSE 1072 as a separate item.
- HD-1 HUB DRAIN: Provide 3" I.D. cast iron hub drain for condensate collection from HVAC equipment. Hub drain shall have p-trap below slab and shall extend to 1" above finished floor. Pipe material shall be per condensate drainage section of these specifications. Support shall be per hangers section of these specifications.
- CB-1 WASHER CONNECTION BOX: Fully recessed fire-rated washing machine outlet box with hot and cold water hose connections, 2" drain outlet and overflow guard. Unit shall be ProSet Fire Guard Washer Box.
- WH-1 WATER HEATER: Gas fired storage tank type water heater with Preset Power burner for Natural gas, nominal 119-gallon glass lined galvanized steel storage tank, ASME constructed, hand hole cleanouts, flame sensor, high limit sensor, power gas burner, magnesium anode rods, minimum foam glass tank insulation, metal tank jacket and ASME pressure-temperature relief valve. Heater shall have capacity of 576 gallons per hour at 100°F temperature rise when fired with 500-CFH of Natural gas. Burner motor and controls shall be factory wired for 120-volt, single-phase electrical service. Unit shall be A.O. Smith BTH-500(A) or approved equal by State, Bradford White, or Rheem. Intake and exhaust connections to heaters shall be made using 4" Schedule 80 CPVC pipe. Transition from manufacturer's included PVC intake or exhaust piping, if applicable, shall be made using transition couplings conforming to ASTM C 1460, comprised of neoprene gasket conforming to ASTM C 564 and stainless steel clamping band. Intake shall be equipped with manufacturer's recommended screen. Exhaust flue condensate drain shall be equipped with a condensate neutralizer system. Thermostat shall be set as indicated on Contract Drawings. Water heater shall be started by the manufacturer's factory representative
- WH-2 WATER HEATER: Shall be electric instantaneous type, 14,000 watt immersion heating element, with microprocessor controlled outlet temperature. Thermostat shall be factory set for temperature indicated on Contract Drawings. Heater shall be wired for 208-volt, three-phase operation and shall be A.O. Smith C2VA-140X, or approved equal by State or Super Supreme.

PARK SUPPORT BUILDING

- WC-1 WATER CLOSET: (Adult ADA) See architectural drawings for bowl, flush valve, and seat specifications. These items are to be provided and installed by Division 22. Contractor should note flush valve rough-in height as shown on the drawings. Flush valve handle shall be roughed in and mounted to the wide side of the toilet stall.
- U-1 URINAL: (Adult ADA) See architectural drawings for bowl, flush valve, and seat specifications. These items are to be provided and installed by Division 22. Lip shall be mounted at height as shown on the drawings.
- L-1 LAVATORY: (ADA) See architectural drawings for bowl and faucet specifications. These items are to be provided and installed by Division 22. Chrome plated lead free angle stops with loose key handle and 1/2" chrome plated nipple to wall and escutcheon with set screw shall be McGuire or approved equal by Zurn or Brasscraft. Stainless steel braided flexible supplies shall be as manufactured by McGuire or approved equal by Brass Craft, Watts. Chrome plated cast brass strainer with open grid, overflow openings, cast brass locknut and 1-1/4" 17 gauge tailpiece shall be McGuire, Zurn, or Engineered Brass Company. 1-1/4" by 1-1/2" chrome plated adjustable cast brass P-trap with 1-1/4" slip in inlet, cleanout, ground joint, 1-1/2" I.P.S. outlet, shall be McGuire, Zurn, or Engineered Brass Company. 1-1/2" chrome plated nipple to wall with escutcheon and setscrew shall be McGuire, Zurn, or Engineered Brass Company. Chair carrier with floor anchor plate, upright supports, and bearing plate shall be Zurn Model Z-1224, J. R. Smith Model 0800, or approved equal by Watts. Lavatory shall be mounted at height as shown on the drawings. Lavatory supplies and trap shall be protected by A.D.A. approved premolded insulation assembly as manufactured by Truebro, McGuire or Mainline.
- SK-1 UTILITY SINK: See architectural drawings for bowl, faucet, P-Trap, and braided supplied specifications. These items are to be provided and installed by Division 22. 1/2" sweat x 1/2" compression sink supply stops shall be equipped with 5" extension, wheel handle ball valve angle stops shall be McGuire, Zurn, or Brasscraft. Install cast brass escutcheons with setscrew on all piping entering base cabinet. Supplies and trap shall be protected by A.D.A. approved premolded insulation assembly as manufactured by Truebro, McGuire or Mainline.
- HD-1 HUB DRAIN: Provide 3" I.D. cast iron hub drain for condensate collection from HVAC equipment. Hub drain shall have p-trap below slab and shall extend to 1" above finished floor. Pipe material shall be per condensate drainage section of these specifications. Support shall be per hangers section of these specifications.
- HB-1 HOSE BIBB: Wall mounted, polished chrome plated brass with 3/4" vacuum breaker hose end, locking shield, tee handle, 1/2" inlet wall flange, Woodford Model 26P-1/2, Mifab MHY-9240, T & S Brass B-0702/B-972 or Preir C-257CP.75.

- HB-2 HOSE BIBB: Rough brass hose bibb with wheel handle, 3/4" vacuum breaker outlet, 1/2" inlet, cast brass or 304 stainless steel wall box, hinged door, loose key door lock, chrome plated or stainless steel exposed finish, Woodford Model B26-1/2-CH, Mifab MHY-95-49 or Metcraft Model 182.
- HB-3 WALL HYDRANT: Non-freeze type with 3/4" copper inlet, 3/4" vacuum breaker or double check hose end, removable key handle, self draining, for wall thickness as required, Woodford Model 67, Zurn Model Z-1310 or Josam Model 71050-12.
- FD-1 FLOOR DRAIN: Cast iron body drain with 4" outlet to match piping system, 6" square nickel bronze heelproof top, vandal resistant securing screws with flashing device, Zurn ZN415S-VP, or approved equal by Josam, J. R. Smith, Wade, or Watts. Install 4" in-line floor drain trap seal, ABS plastic housing with EPDM rubber diaphragm and soft rubber sealing gasket, conforming to ASSE 1072 as a separate item.
- FD-2 FLOOR DRAIN: Cast iron body drain with 2" outlet to match piping system, 6" square nickel bronze heelproof top, vandal resistant securing screws with flashing device, Zurn ZN415S-VP, or approved equal by Josam, J. R. Smith, Wade, or Watts. Install 2" in-line floor drain trap seal, ABS plastic housing with EPDM rubber diaphragm and soft rubber sealing gasket, conforming to ASSE 1072 as a separate item.
- FD-3 FLOOR SINK: 12" x 12" x 8" deep cast iron body floor sink with 3" outlet to match piping system, anchor flange, white acid resistant enameled interior, white acid resistant dome strainer, half nickel bronze grate, Zurn Z-1901-K-2-33, or approved equal by Josam or J. R. Smith.
- WH-1 WATER HEATER: Shall be electric instantaneous type, 6000 watt immersion heating element, with microprocessor controlled outlet temperature. Thermostat shall be factory set for 110 degrees. Provide stainless steel finish. Heater shall be wired for 208-volt, three-phase operation and shall be Chromomite Laboratories, Inc. Model E-60L/208-SS, or approved equal by Eemax or Rheem.

220032 GUARANTEE

- A. Guarantee: The Contractor shall guarantee the entire plumbing system subject to the General Conditions of these specifications.

220033 BIDDING PROCEDURE

- A. The Contractor shall provide bidding for Alternate Bids in accordance with Division 1. Contractor shall refer to Division 1 for any required unit prices and allowances.

END OF SECTION 220000

SECTION 224200 - COMMERCIAL PLUMBING FIXTURES

PART 1 - GENERAL

1.1 SUMMARY

- A. Section includes plumbing fixtures and fittings.
- B. Related Documents and Sections: Examine Contract Documents for requirements that directly affect or are affected by Work of this Section. Other Documents and Sections that directly relate to work of this Section include, but are not limited to:
 - 1. General provisions of the Contract, including General and Supplementary Conditions, and Division 01 General Requirements Specification Sections.
 - 2. Division 22 - PLUMBING.
 - 3. Division 26 - ELECTRICAL.

1.2 SUBMITTALS

- A. Product Data: For each type of product.
 - 1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for water closets.
 - 2. Include rated capacities, operating characteristics, electrical characteristics, and furnished specialties and accessories.
 - 3. Where manufacturer's catalog information does not clearly indicate construction details or aesthetics of fixtures, equipment samples shall be submitted before review.
- B. Shop Drawings: Include diagrams for power, signal, and control wiring.
- C. Operation and Maintenance Data: For flushometer valves and electronic sensors to include in operation and maintenance manuals.

1.3 QUALITY ASSURANCE

- A. Fixtures shall be free from imperfections, true as to line, angles, curves, and color. Fixtures shall be smooth, watertight, and practically noiseless in operation.
- B. If products of alternate manufacturers are selected, the alternate products shall have clearances, waterways, water use characteristics, and assembly equal to that of the plate number of the products specified.

PART 2 - PRODUCTS

2.1 GENERAL REQUIREMENTS

- A. All plumbing fixtures shall be new, in good condition and free from defect. The commercially standard items of equipment and the specific names mentioned herein are intended to identify standards of quality and performance necessary for the proper function of the work.
- B. Since manufacturing methods vary, reasonable minor variations are expected; however, performance and material requirements specified herein are the minimum standards acceptable. The Architect retains the sole right to judge the equality of equipment that deviates from the Contract Documents, to reject any alternative submitted by the Contractor, and to require the specified materials and equipment, which conform to the requirements of the Contract Documents be furnished.
- C. Plumbing fixtures that are found to have factory defects shall be replaced or repaired in a manner acceptable to the Owner and Architect at no additional cost to the Owner. The Contractor shall be responsible for all costs associated with testing, replacement or repair including, but not limited to, all replacement or repair costs, preparations prior to testing, all testing costs, extended warranties, recommissioning of the equipment, etc.
- D. All fixtures shall be free from imperfections, true as to line, angles, curves and color, smooth, watertight, and complete in every respect.
- E. All fixtures specified shall be of the best quality, nonabsorbent and discolored. Warped or otherwise imperfect fixtures shall not be accepted.
- F. All fixtures shall be furnished by one (1) manufacturer unless otherwise specified.
- G. All fixtures shall be certified to NSF 61 standards for drinking water system components.
- H. All exposed fittings shall be chrome-plated cast brass with set screw escutcheons. Escutcheons shall be brass, chrome-plated over nickel plate with brushed chrome finish. Any hanger nuts visible shall likewise be chrome-plated over nickel plate.
- I. Provide chrome-plated cast brass traps with cleanout plugs, unless otherwise noted.
- J. Provide concealed support for wall-mounted fixtures.
- K. Vitreous Ware: Fired vitreous china ware of the best quality, non-absorbent and burned so that the whole mass is thoroughly fused and vitrified, producing a material white in color, which when fractured will show a homogeneous mass, close-grained and free from pores. Glaze and finish shall be thoroughly fused and united to the body, without discoloration chips or flaws, and shall be free from crazing or cracks. Warped or otherwise imperfect fixtures will not be accepted.
- L. Exposed Trim: Including all fittings, escutcheons, faucets, traps, exposed piping, etc., shall be brass, chrome plated over nickel plate with polished finish. Any hanger nuts visible shall likewise be chrome plated over nickel plate.

- M. Provide supply stops with renewable seats for each plumbing fixture.
- N. All fixture colors shall be specified by Architect.
- O. All cold water faucets and supplies shall be to the right and open clockwise. All hot water faucets and supplies shall be to the left and open counter clockwise.
- P. All shower arms shall be secured to construction to prevent movement.

2.2 PLUMBING FIXTURES

A. F-01

- 1. Item: Toilet
- 2. Manufacturer: American Standard
- 3. Model #: 3641.001.020
- 4. Color/Finish: White
- 5. Description/Location: Right Width 1.28 GPF Flowise Right Height Elongated Flushometer Toilet With Seat

B. F-02

- 1. Item: Urinal
- 2. Manufacturer: American Standard
- 3. Model #: 6590.005
- 4. Color/Finish: White
- 5. Description/Location: Washbrook Flowise 0.5gpm High Efficiency Urinal With Top Spud, Manual Valve, #6045.051.002

C. F-03

- 1. Item: Lavatory
- 2. Manufacturer: American Standard
- 3. Model #: 0954.004EC
- 4. Color/Finish: White
- 5. Description/Location: 'Murro' Universal Design Wall-Hung Lavatory, Faucet Holes 4" Center With Shroud/Knee Contact Guard

D. F-04

- 1. Item: Janitor Sink
- 2. Manufacturer: American Standard
- 3. Model #: 7695.008
- 4. Color/Finish: White
- 5. Description/Location: Akron Service Sink With Drilled Back 2 Holes On 8" Centers And "P" Trap For 3" Pipe

E. F-05

- 1. Item: Faucet
- 2. Manufacturer: American Standard

3. Model #: 775B.105
4. Color/Finish: Chrome Finish
5. Description/Location: Nextgen Selectronic Integrated Proximity Lavatory Faucet, .5 Gpm Pressure Compensating, Vandal-Resistant Multi-Laminar Spray

F. F-06

1. Item: Catering Kitchen Sink
2. Manufacturer: Regency
3. Model #: 600S1172324 LFT
4. Color/Finish: Stainless Steel
5. Description/Location: 16 Gauge Stainless Steel One Compartment Sink W/ One Drainboard (Left)

G. F-07

1. Item: Double Bowl Sink
2. Manufacturer: American Standard
3. Model #: 18DB6332211.075
4. Color/Finish: Stainless Steel
5. Description/Location: 'Edgewater' 33" X 22" Ada Double Bowl Stainless Steel Kitchen Sink, At 100 Catering, 132-Pantry & 136-Crew

H. F-08

1. Item: Kitchen Faucet
2. Manufacturer: American Standard
3. Model #: 4175.700.002
4. Color/Finish: Chrome Finish
5. Description/Location: Colony Choice 1 Handle Kitchen Faucet

I. F-09

1. Item: Plastic Utility Tub Sink
2. Manufacturer: Mustee
3. Model #: 28CF
4. Color/Finish: White
5. Description/Location: At 137-Storage

J. F-10

1. Item: Undermount Sink
2. Manufacturer: Kohler
3. Model #: Caxton Oval K.2210
4. Color/Finish: White
5. Description/Location: At 160-Bath 1, 162-Bath 2, 164-Bath 3, 166-Bath 4, 168-Bath 5, & 170-Bath 6

K. F-11

1. Item: Dressing Room Faucet

2. Manufacturer: American Standard
3. Model #: 7075.000
4. Color/Finish: Chrome Finish
5. Description/Location: Colony Pro Single Control Lavatory Faucet, At 160-Bath 1, 162-Bath 2, 164-Bath 3, 166-Bath 4, 168-Bath 5, & 170-Bath 6

L. F-12

1. Item: VIP Lavatory
2. Manufacturer: Duravit
3. Model #: 0684600000
4. Color/Finish: White
5. Description/Location: Scola Washbasin, At 173-VIP Women's Lav & 174-VIP Men's Lav

M. F-13

1. Item: VIP Faucet
2. Manufacturer: Kohler
3. Model #: K-13461
4. Color/Finish: Chrome Finish
5. Description/Location: Electronic Faucet, At 173-VIP Women's Lav & 174-VIP Men's Lav

N. F-14

1. Item: ADA Shower System
2. Manufacturer: American Standard
3. Model #: Commercial Shower System With Hand Shower And Fixed Shower Head
4. Color/Finish: Chrome Finish
5. Description/Location: Shower 1, 2, And Bath 6

O. F-15

1. Item: Terrazzo Shower Floor
2. Manufacturer: Fiat
3. Model #: 36 MFT ADAT
4. Color/Finish: White
5. Description/Location: 36" X 36" Monterey Mft Series, Precast Terrazo Shower Floor

P. F-16

1. Item: Standard Shower System
2. Manufacturer: American Standard
3. Model #: Fixed Shower Head Studio S Collection
4. Color/Finish: Chrome Finish
5. Description/Location: Showers 3 & 4, And Baths 1-5
 - a. Provide blocking at showers for future installation of grab bars

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine roughing-in of water supply and sanitary drainage and vent piping systems to verify actual locations of piping connections before fixture installation.
- B. Examine walls and floors for suitable conditions where fixtures will be installed.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 FIXTURE SUPPORTS

- A. Provide all hangers, supports, brackets, etc., for the proper installation of the lavatories, sinks, etc., requiring support.
- B. Such supports shall be in accordance with the recommendations of the manufacturers of the fixtures, and if built into partitions or walls shall be set as the wall construction progresses.

3.3 INSTALLATION

A. Fixture Installation:

- 1. Assemble/Preassemble fixture components as necessary according to manufacturer's written instructions.
- 2. Install fixtures level and plumb according to roughing-in drawings.
- 3. Install fixtures with proper support and anchorage, affixed to building substrate.
- 4. Install fixtures with water-supply stops on each supply to each fixture.
 - a. Exception: Use ball, gate or globe valves if supply stops are not specified with fixtures.
 - b. Install stops in locations where they can be easily reached for operation.
- 5. Connect fixtures to required piping using seals, fittings, gaskets, adaptors and etc. to provide leak-tight installations.
- 6. Install accessible fixtures at mounting heights for handicapped/elderly, according to ICC/ANSI A117.1.
- 7. Provide and install protective shielding pipe covers and enclosures on exposed supplies and waste piping of accessible fixtures.

B. Support Installation:

- 1. Install supports, affixed to building substrate, for supporting and securing fixtures.
- 2. Use carrier supports with waste-fitting assembly and seal.
- 3. Install floor-mounted, fixtures attached to building floor substrate, onto waste-fitting seals; and attach to support.
- 4. Install wall-mounted, fixture supports with waste-fitting assembly and waste-fitting seals; and affix to building substrate.

C. Other Fixture Installation Requirement:

1. Install Toilet seats on water closets.
2. Install shower flow-control fittings with specified maximum flow rates in shower arms.
3. Set shower receptors, shower basins, floor mounted sinks and mop basins in leveling bed of cement grout.

D. Wall Flange and Escutcheon Installation:

1. Install wall flanges or escutcheons at piping wall penetrations in exposed, finished locations and within cabinets and millwork.
2. Install deep-pattern escutcheons if required to conceal protruding fittings.

E. Joint Sealing:

1. Seal joints between fixtures, counters, walls and floors using sanitary-type, one-part, mildew-resistant silicone sealant.
2. Match sealant color to fixture color.

3.4 CONNECTIONS

- A. Connect fixtures with water supplies, stops, and risers, and with traps and soil, waste, and vent piping as necessary. Use size fittings required to match fixtures.
- B. Comply with water piping requirements specified elsewhere in Division 22.
- C. Comply with soil and waste piping requirements specified elsewhere in Division 22.
- D. Where installing piping adjacent to fixtures, allow space for service and maintenance.

3.5 ADJUSTING

- A. Operate and adjust fixtures and controls. Replace damaged and malfunctioning fixtures, fittings, and controls.
- B. Adjust water pressure at fixtures to produce proper flow.

3.6 CLEANING AND PROTECTION

- A. After fixture installation is complete, inspect fixture finishes for damages. Replace any damaged fixtures unless damages can be repaired to "as new" condition.
- B. Clean fixtures, faucets, fixture accessories and fittings with manufacturers' recommended cleaning methods and materials.
- C. Provide and install protective covering for installed fixtures and fittings.
- D. Do not allow use of fixtures for temporary facilities unless approved in writing by Owner.

3.7 WASTE MANAGEMENT

- A. Separate and dispose of waste in accordance with the Project's Waste Management Plan.

END OF SECTION

SECTION 230500 - HEATING AND AIR CONDITIONING

230501 GENERAL

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.
- B. The Heating and Air Conditioning Contractor shall cooperate with the contractors of other trades and shall install his work as fast as the progress of the balance of the work will permit.
- C. See Section 013100 for requirements for Coordination Drawings.
- D. The Heating and Air Conditioning Contractor shall install all work in accordance with the requirements of the latest edition of the North Carolina State Building Code. Codes to be a part of these specifications: North Carolina State Building Code, National Fire Protection Association Codes Section 70, 90A, 91, and other applicable sections.
- E. Inspection by local authorities will be required.
- F. The drawings accompanying these specifications indicate diagrammatically the general location of the ducts, piping, and equipment and do not show all offsets, supports, fittings, bolts, connections, etc., required for a complete system. While the drawings are to be followed as closely as possible, if it is found necessary to change the location of same to accommodate the conditions at the building, such changes shall be made without additional cost to the Owner, and as directed by the Engineer. Any detail which is omitted, and which is necessary for the proper operation of any system included under the contract, shall be supplied and installed by the Heating and Air Conditioning Contractor without extra cost to the Owner. All pipes and ducts shall be run as high as possible to maintain ceiling and head clearance. All equipment shall be installed in such a manner as to allow proper maintenance access.
- G. Equipment and Materials shall be delivered to the site and stored in original containers, suitably sheltered from the elements, but readily accessible for inspection by the Engineer until installed. All items subject to moisture damage shall be stored in dry spaces.
- H. Conditions shall be checked at the building before placing orders for apparatus and such apparatus shall be of such dimensions as to fit the spaces allotted. The Heating and Air Conditioning Contractor shall not scale mechanical plans, but rather refer to architectural plans for dimensions.
- I. By signing the Contractor's Proposal, it is understood and agreed that the Heating and Air Conditioning Contractor has, by careful examination, satisfied himself with the quantity, quality, and location of all excavation materials to be encountered in his contract. No additional payment will be approved for well pointing or any other existing conditions encountered. Refer to Division 31 for site work requirements.
- J. All debris resulting from heating and air conditioning work shall be removed from the premises daily or as directed by the Engineer. Trash and rubbish shall not be allowed

to accumulate either within or outside the building. Materials and debris, which in the opinion of the Engineer cannot practicably be removed from the site the same day, may be temporarily stacked or stored in a designated location on the site as directed by the Engineer.

- K. Guards shall be provided for all moving equipment, motor couplings, belt drives and similar exposed reciprocating or rotating components.
- L. All HVAC and refrigeration equipment shall be labeled in accordance with Section 301 of the North Carolina Mechanical Code and as required by the Authority having jurisdiction. Labeling shall be a permanent factory-applied nameplate affixed to the equipment on which shall appear in legible lettering, the manufacturer's name or trademark, the model, serial number, and the seal or mark of the testing agency.

230502 SCOPE

- A. The Heating and Air Conditioning Contractor shall provide labor and materials required for a complete system ready for operation as shown on the drawings and hereinafter specified. This includes all equipment, ductwork, necessary plumbing, and all other services necessary whether they are specifically mentioned herein or not. The entire installation shall be installed in a first-class, neat, professional manner to the satisfaction of the Engineer and shall conform to all applicable codes and laws.

230503 SHOP DRAWINGS AND SUBMITTAL DATA

- A. The Heating and Air Conditioning Contractor shall submit within 10 days after award of the contract a list of materials and the manufacturer to be used on this project. He shall submit within thirty days after award of the contract at least five copies of submittal data in written form for the Engineer's use in approving materials and equipment. One copy will be returned. If the Heating and Air Conditioning Contractor desires the return of more than one copy, additional copies shall be provided to the Engineer at the time of the original submission. It is requested that all submittal data be sent to the Architect at one time. Unless special consideration is given, none of the submittal data will be checked until it has all been received by the Architect. Where called for, the Heating and Air Conditioning Contractor shall submit five sets of shop drawings showing the detailed arrangement or connections that are shown schematically on the drawings. Data certified for the specified project and indicated manufacturer, type, or size, capacity, etc., shall be submitted for the following equipment items:
 - 1. Split System Heat Pumps
 - 2. Split System Ductless Heat Pumps
 - 3. Variable Refrigerant Flow Systems
 - 4. Dedicated Outside Air Units
 - 5. Power Ventilators and Louvered Penthouses
 - 6. Diffusers, Grilles, and Registers
 - 7. Heaters
 - 8. Controls with Complete Diagram
 - 9. Manual and Motor Operated Dampers
 - 10. Insulation
 - 11. Seismic Restraints
 - 12. Testing and Balancing

230504 APPROVED EQUAL EQUIPMENT, ETC.

Manufacturers listed are to establish a standard of quality and not intended to limit the selection to these manufacturers. All materials and equipment which are essential and have not been specified or shown shall be new and of the highest grade and quality, free from defect or other imperfections. It should be understood that where the word "provide" is used, it is intended that the Heating and Air Conditioning Contractor shall purchase and install all materials required. Approval of equipment will not relieve the Contractor of compliance with the specifications even if such approval is made in writing, unless the attention of the Engineer is called to the non-complying features by letter accompanying the submittal data. Approval of submittal data by the Engineer shall not be construed as a complete check of approval of detailed dimensions, weights, gauges, and similar details with the proposed articles. The conformance with the necessary coordination between the various other contractors and suppliers shall be solely the responsibility of the Heating and Air Conditioning Contractor.

230505 SPLIT SYSTEM HEAT PUMPS

- A. Indoor air handling unit section shall be UL or ETL labeled draw-thru design complete with centrifugal fans, condensate drain pan, refrigerant coil, insulated cabinet, electric resistance auxiliary heaters, and filters. Coil shall be dual circuit where indicated with non-ferrous tubes mechanically bonded to plate fins. The fan section shall have direct driven forward-curved fans with variable speed adjustment. The cabinets shall be internally insulated and shall be constructed of 16-gauge galvanized steel with baked enamel finish. Auxiliary electric strip heaters shall be by the heat pump manufacturer and shall be UL or ETL approved to be installed in the unit in the reheat position or at the unit's discharge. Units hanging shall have neoprene type vibration isolators on all unit support hangers.
- B. Filters shall be 2" thick UL Class 1 pleated panels with Minimum Efficiency Reporting Value of MERV 8 per ASHRAE Standard 52.2-1999. Contractor shall supply complete sets of filters to protect his equipment during construction, changes of filters at testing and balancing, another change of filters at completion, and leave one additional complete set of filters at the building for the next change. Provide factory supplied fixed filter blockoffs to prevent air bypass around filters.
- C. Outdoor section shall be UL labeled and AHRI rated and certified with its air handling unit and bear the AHRI seal. The fans shall be permanently lubricated, direct drive, propeller type. The compressors shall be hermetic using R-410A refrigerant with suction and discharge stop valves, crankcase heaters, automatically reversible oil pump, oil filter, internal thermostat, and controls for low ambient temperature operation. The unit controls shall include compressor staging, a high and low pressurestat of the automatic reset type, a positive acting five minute timer to prevent short cycling and a motor starting and protecting equipment. Units shall be furnished with coil guards and units shall have factory seacoast coating.
- D. See GUARANTEE 230531 for description of unit and compressor warranty requirements.

- E. Refrigerant piping systems shall be sized, pitched, and furnished with all specialties as recommended by the unit manufacturer to accommodate refrigerant piping lengths. Specialties shall include suction line accumulators, liquid line solenoid valves, thermal expansion valves, refrigerant sight glass, removable core filter drier, and any other item deemed necessary or recommended by the unit manufacturer.
- F. Indoor and outdoor sections shall be by the same manufacturer and shall be Trane, Carrier, Daikin or approved equal.

230506 SPLIT SYSTEM DUCTLESS HEAT PUMPS

- A. Indoor section shall be vertical wall, ceiling cassette, or ceiling mounted ductless type split heat pump unit. Unit cabinet shall be 20 gauge-galvanized steel with rounded corners and finished with an undercoat and topcoat of hard finish polyurethane paint. Unit shall be internally insulated and be furnished with auxiliary heater and 1" thick pre-cut washable polyester filter media. Contractor shall supply sets of filters to protect equipment during construction, another change of filters at final completion, and leave an additional complete set of pre-cut filters at the building for the next change. Unit fan shall be dual tangential blower type. Unit shall have hardwired wall-mount temperature controller with high-medium-low fan control and pan mounted condensate pump. High condensate limit switch shall deenergize unit if condensate pump fails to function.
- B. Outdoor section shall be by the same manufacturer as the indoor section. Units shall be compact low profile type with inverter driven compressor, R410A refrigerant, crankcase heaters, and controls for low ambient temperature operation in cooling mode down to 0°F. The fans shall be permanently lubricated, direct drive, side discharge type. Safety controls shall include loss of charge and low and high pressure switch. Coils shall have coil guards and shall have factory seacoast coating. See Article 230531 GUARANTEE for description of compressor warranty requirements.
- C. Refrigeration compressors for heat pump units shall have a four-year extended warranty for the compressors only. Labor, freight, and other required parts shall be provided or paid for by the Owner.
- D. Refrigerant piping systems shall be sized, pitched, and furnished with all specialties as recommended by the unit manufacturer to accommodate refrigerant piping lengths. Specialties shall include suction line accumulators, liquid line solenoid valves, thermal expansion valves, refrigerant sight glass, removable core filter drier, and any other item deemed necessary or recommended by the unit manufacturer.
- E. Units shall be UL or ETL labeled and shall be Daikin, Mitsubishi, Sanyo, Friedrich, LG, or approved equal.

230507 VARIABLE REFRIGERANT FLOW SYSTEMS

- A. Variable Refrigerant Flow Systems (VRF) shall be simultaneous heating/cooling (heat recovery) systems consisting of outdoor units, BC (Branch Circuit) Controllers (or comparable branch devices), multiple indoor units, and an integral DDC (Direct Digital Controls) system. Each indoor unit or group of indoor units shall be capable of operating in any mode independently of other indoor units or groups. System shall be capable of changing mode (cooling to heating, heating to cooling) with no interruption to system

operation. To ensure owner comfort, each indoor unit or group of indoor units and their temperature controller shall be independently controlled and capable of changing mode automatically to satisfy heating or cooling regardless of time of day, occupancy, or season without inhibiting or affecting other space temperature controllers.

- B. All VRF system components shall be by the same manufacturer.
- C. Indoor units shall be four-way blow ceiling recessed ductless cassette type unit or ducted cabinet type as indicated on the drawings. Unit cabinet shall be 20 gauge galvanized steel with rounded corners and finished with an undercoat and topcoat of hard finish polyurethane paint. Unit shall be internally insulated and have 1" thick pre-cut washable polyester filter media. Unit fan shall be dual tangential blower type. Four-way blow units shall have adjustable air outlet system to provide 4-way airflow, 3-way airflow, or 2-way airflow. Units shall include electronic modulating expansion device, control circuit board, self-diagnostic function, 3-minute time delay mechanism, an auto restart function, and a test run switch. Units shall be factory run tested.
- D. Outdoor section shall be multiple modules of air cooled, DX units with inverter driven compressor(s), R410A refrigerant, accumulator with refrigerant level sensors and controls, high pressure safety switch, over current protection, crankcase heaters, DC bus protection, and controls for operation in cooling mode down to 23°F ambient temperature and in heating mode down to -4°F ambient temperature. Units shall have system and controls to maintain proper oil volume in the compressor(s). The fans shall be permanently lubricated, direct drive, variable speed type. Units shall be factory run tested. Units shall have factory provided field installed hail guards over the condenser coils.
- E. Branch Circuit (BC) Controllers (or comparable branch devices) shall include multiple branches to allow simultaneous heating and cooling by allowing either hot gas refrigerant to flow to indoor unit(s) for heating or subcooled liquid refrigerant to flow to indoor unit(s) for cooling. Units shall be galvanized steel cabinet completely factory assembled, piped and wired including circuit board controls interface, liquid-gas separator, multiple tube-in-tube heat exchangers, and multiple refrigeration control valves. Unit shall be mounted indoors, with access and service clearance provided for each controller. BC Controllers (or comparable branch devices) shall be suitable for use in plenums in accordance with UL1995. Units shall be factory run tested.
- F. Refrigerant piping systems shall be sized, pitched, and furnished with all specialties as recommended by the VRF system manufacturer to accommodate refrigerant piping lengths and installation requirements. Specialties may include suction line accumulators, liquid line solenoid valves, thermal expansion valves, refrigerant sight glass, removable core filter drier, and any other item deemed necessary or recommended by the unit manufacturer. Service shut-off valves including access ports shall be field-provided/installed for each branch to allow service to any indoor unit without field interruption to overall system operation. Valves shall have seals and gaskets of material as required by the VRF system manufacturer.
- G. Condensate handling shall include where necessary a condensate pump with check valve and condensate float switch. Float switch shall disable the indoor unit in the event of condensate overflow.

- H. Systems start-up and testing shall be a required service to be completed by the manufacturer or a duly authorized, competent representative that has been factory trained in system configuration and operation. The representative shall provide proof of manufacturer certification indicating successful completion within no more than two (2) years prior to system installation. This certification shall be included as part of the equipment and/or controls submittals.
- I. The VRF systems shall be covered by the manufacturer's limited warranty for a period of one (1) year parts and seven (7) year compressor to the original Owner from date of installation. Installing contractor shall meet manufacturer requirements to obtain extended manufacturer's limited parts and compressor warranty for a period of ten (10) years to the original Owner from date of installation. Manufacturer's warranty shall not include labor.
- J. Controls:
 - 1. VRF System Controls, installation, and integration shall be provided by the manufacturer of the VRF system.
 - 2. Installed system shall be a complete and functional networked system with all necessary controllers, devices, wiring, and VRF central controller with color touchscreen display capable of remote WEB access via Owner provided LAN. Central controller shall have BACnet interface for tie-in to a future Building Automation System.
 - 3. Password shall protect the VRF control system from unauthorized access, whether through the touchscreen system interface or the web based system interface. Each operator is assigned a role. Roles are defined by access rights. Pre-defined roles shall be selected from the VRF System Controller interface. Operators shall have access only to those features which define their roles. Roles may also be customized. An operator with administrative-level security shall access all information on the system, and shall have the ability to alter passwords and create new security roles.
 - 4. Each individual space temperature controller shall be capable of automatically satisfying heating or cooling regardless of time of day, occupancy, or season without inhibiting or affecting other space temperature controllers.
 - 5. Space temperature controllers shall wall mounted hardwired type with multi-function LCD display and the following functionality:
 - a. Power on/off setting
 - b. Mode selection
 - c. Temperature set point control
 - d. Fan speed setting
 - e. On/off timer
 - f. Controls up to 16 idus
 - g. Up to 2 simple remotes may be configured as Master Slave for 1 IDU
 - h. Child lock
 - i. Filter timer
 - 6. Control system wiring and execution shall be in accordance with the Electrical Division, Division 26, of these specifications.
- K. Systems shall be UL or ETL labeled and shall be Mitsubishi, LG, Daikin, or approved equal.

230508 DEDICATED OUTSIDE AIR UNITS

- A. Units shall be 100% outside air DX cooling type with horizontal discharge, no return/relief/recirculation, natural gas heat, and hot gas reheat.
- B. Units shall be horizontal discharge as indicated on the drawings, with cooling performance rated in accordance with ARI standards. Unit shall be factory assembled, piped, internally wired, fully charged with R-410A and 100% run tested to check full operation, fan and blower rotation and control sequence before leaving the factory. Wiring internal to the unit shall be numbered for simplified identification. Unit shall be UL listed and labeled, classified in accordance to UL 1995/CAN/CSA No. 236-M90 for Central Cooling Air Conditioners.
- C. Unit casing shall be double wall constructed of zinc coated, heavy gauge, galvanized steel with 2" thick insulation between walls. Exterior surfaces shall be cleaned, phosphatized, and finished with a weather-resistant baked enamel finish. Unit's surface shall be tested 1000 hours in a salt spray test in compliance with ASTM B45. The unit's base pan shall have no penetrations within the perimeter of the curb other than the raised downflow supply/return openings. Top cover shall be one piece construction or, where seams exist, shall be double-hemmed and gasket-sealed. Access doors shall be hinged.
- D. Compressors shall be direct-drive, hermetic, scroll type, digital primary and secondary, with centrifugal type oil pumps. Motor shall be suction gas-cooled and shall have a voltage utilization range of plus or minus 10 percent of unit nameplate voltage. Internal overloads shall be provided with the scroll compressors. Crankcase heaters shall be included. Digital primary and secondary compressors shall be able to fully modulate from 20%-100%. Provide multi-stage capability as indicated on the drawings.
- E. Evaporator coil shall be six row interlaced internally finned, 5/16" copper tubes mechanically bonded to a configured aluminum plate fin. Coils shall be leak tested at the factory. The evaporator coil shall be leak tested to 500 psig and pressure tested to 500 psig.
- F. Hot gas reheat coil shall be modulating type located on the leaving air side of the evaporator coil prepped and circuited with a low pressure switch.
- G. Condenser coil shall be 5/16" copper tubes mechanically bonded to a configured aluminum plate fin. Coils shall be leak tested at the factory. The evaporator coil shall be leak tested to 500 psig and pressure tested to 500 psig. Provide guards on units to fully protect condenser coils from hail and vandalism.
- H. Condenser, evaporator, and hot gas reheat coils shall be coated with a field-applied, third-party non-metallic, non-bridging corrosion barrier material by a factory trained and authorized applicator. Coating shall meet ASTM B117 3000-hour accelerated salt spray test and shall have negligible (less than 1%) impact on equipment's capacity/performance.
- I. Condensate drain pan shall be insulated positively sloped of durable, long-lasting and corrosion resistant construction.

- J. Indoor supply fan shall be a high efficiency backward curved plenum type with ECM motor with integrated power electronics or VFD, but will be constant volume supply air. Provide with fan airflow monitoring piezo ring and tap. Integrate airflow cfm signal to DDC system.
- K. Outdoor fans shall be direct drive vertical discharge design with low-noise corrosion resistant glass reinforced polypropylene props, powder coated wire discharge guards and electro-plated motor mounting brackets. Fans shall be statically and dynamically balanced with VFD control for head pressure control, reheat capacity, and low ambient control.
- L. Heating section shall be indirect fired with stainless steel heat exchanger and burner, forced draft combustion via direct spark ignition, and 8:1 minimum turndown for firing natural gas. Gas connection to unit shall be through roof curb base. Heat exchanger shall have factory 10-year warranty.
- M. Filters shall be 2" thick UL Class 1 pleated panels with Minimum Efficiency Reporting Value of MERV 8 per ASHRAE Standard 52.2-1999. Contractor shall supply complete sets of filters to protect his equipment during construction, another change of filters at completion, and leave one additional complete set of filters at the school for the next change. Provide factory supplied fixed filter blockoffs to prevent air bypass around filters.
- N. Unit's dampers shall have metal compressible jamb seals and extruded vinyl blade edge seals. Units shall have motorized outside air intake, and return air dampers where indicated on the drawings, to open and provide the specified outside air. Outside air intake opening shall have rain hood with moisture eliminator and bird screen.
- O. Units shall be completely factory wired with necessary controls and terminal block for power wiring. Units shall have a single point through base power entry with external location for mounting fused disconnect device. Unit protection shall include anti-short cycle timing and phase monitoring.
- P. Units shall have factory wired controls, factory mounted controller for space temperature and relative humidity control, and unit mounted display device for operator service tool interface. Controller shall be BACnet. Space sensors shall have warmer/cooler adjustment, occupancy override pushbutton, service tool connection jack, and no display.
- Q. Curbs shall be custom made from 12 gauge or heavier as required galvanized steel with welded construction, vibration isolation type where indicated on the drawings, and 1-1/2" thick rigid insulation. Curb height shall be a minimum of 16" high above finished roof height. Secure curb to roof structure and unit to curb per manufacturer's recommendations for site's seismic and wind zone loading.
- R. Startup and testing shall be by factory authorized service representative.
- S. Refrigeration compressors for new units shall have a four-year extended warranty for the compressors only. Labor, freight, refrigerant, and other required parts shall be provided or paid for by the Owner.

- T. Units shall be Trane, Carrier, York or approved equal.

230509 POWER VENTILATORS AND LOUVERED PENTHOUSES

- A. Power ventilators shall be tested and rated in accordance with the standards of AMCA 210 and shall carry the AMCA seal. All fans shall be UL labeled. Fans shall be Cook, Greenheck, Carnes, Twin City, PennBarry, or approved equal.
- B. Ceiling exhaust fans shall have plug disconnect switch, interior fiberglass insulation, forward curved centrifugal blower wheel, back draft dampers, permanently lubricated motor, and white steel grille. Units shall have solid-state motor speed controller with an "OFF" position. Furnish wall cap with birdscreen and backdraft damper where shown on drawings. Caps shall be aluminum or stainless steel, with baked enamel finish of color selected by the Architect.
- C. Inline fans shall be centrifugal in-line ventilator with variable speed belt drive or direct drive as indicated on the drawings. Housing shall be constructed of steel with removable drive door and access panel. Wheel shall be dynamically and statically balanced. Motor base shall be adjustable and have locking screws and guides to provide positive belt tension and correct alignment. Ball bearings shall be heavy-duty self-aligning, relubricable flange type with locking collars. Bearings must be selected for 125,000 hours average service life at maximum cataloged operating speed. Drives shall be cast iron and have a minimum of 1.25 service factor. Drives shall be isolated from the airstream. Motors shall be EISA 2007 NEMA premium efficiency with efficiency rating stamped on motor nameplate. All units shall be provided with backdraft dampers, hanging vibration isolators, motor/drive guards, and disconnect switches. Direct drive units shall have solid-state motor speed controllers with an "OFF" position.
- D. Louvered penthouses shall have the top panel insulated with 1-1/2" fiberglass rigid insulation and shall be hinged. Bird screen shall be 1/2" x 1/2" PVC coated wire. Louvered penthouses shall be aluminum with mitered corner waterproof louvers and factory aluminum finish. Provide vertical snow and storm baffle at base to protect against storm driven rain and snow.
- E. Roof curbs for roof-mounted equipment shall be provided by the Heating and Air Conditioning Contractor. It shall be the responsibility of the Heating and Air Conditioning Contractor to give the General Contractor the proper locations and sizes required for all roof openings. Opening will be framed and cut by the General Contractor. Roof curbs shall be insulated. Equipment shall be attached to roof curbs with a minimum of two stainless steel fasteners and EPDM washers on each side of roof curb.

230510 DIFFUSERS, GRILLES, AND REGISTERS

- A. Diffusers, Grilles, and Registers shall be as manufactured by Carnes, Metal Aire, Titus, Krueger, Price, or approved equal unless otherwise noted.
- B. All diffusers, grilles, and registers shall have a maximum NC level of 25 in the space for the specified airflow, and shall have factory applied white baked enamel finish. Where indicated on drawings to be field painted, white factory finish shall be as necessary to receive field finish painting.

- C. Lay-In Supply Air Diffusers: Shall be aluminum construction, fixed square louvered face, 4-way blow, panel type to drop in 24" x 24" "T" bar ceiling grid, with adjustable vertical pattern. Vertical air adjustment shall be made by adjusting four perimeter blades to force air down in the vertical position.
- D. Ceiling Supply Air Diffusers: Shall be aluminum construction square, fixed square louvered face, 4-way blow, panel border, adjustable vertical pattern, and opposed blade damper.
- E. Lay-in Ceiling Return Air Registers: Shall be aluminum 1/2" x 1/2" egg crate with aluminum frame and designed to lay in an inverted "T" bar ceiling grid. Registers shall have opposed blade dampers and be full flow across the entire face of grille and tapered up to neck size.
- F. Side Wall Return Air Registers: Shall be aluminum with fixed blades on 1/2" centers set at 35° angles and opposed blade dampers.

230511 HEATERS

- A. Electric baseboard heaters shall be commercial-grade furnished and installed complete with all necessary heating elements, brackets, and closures, splice plates, interior and exterior corners, and accessible wiring compartment. Maximum leaving air temperature at the outlet and enclosure surface temperature, under continuous operation, shall not exceed 200°F. Heaters shall be Markel Series 2900C, Q-Mark, Raywall or approved equal complete with UL label.

Heating elements shall consist of stainless-steel element rod with aluminum fins. Maximum watt density per linear foot of element shall not exceed 250 watts. Enclosures shall be steel with thicknesses not less than 18 gauge front and 22 gauge back and shall be rigidly reinforced. Enclosures shall be wall hung with bottom at elevation above the finished floor as shown on the drawings, and shall be suitable for the space available. End plates and corner pieces shall be die formed with round edges, fit flush with enclosure surface, and be neat in appearance. No direct contact between enclosure and heating element will be permitted. Enclosure shall be painted with rust-inhibiting paint at the factory and shall have baked enamel finish of color selected by Architect. Connection box shall be designed to permit power supply and control wiring from bottom, rear, right or left side as required. Thermostat shall be built-in double pole double throw adjustable with extra sensitive bulb and capillary. Thermostat shall have positive off position and be within unit enclosure or junction box. Limit controls shall be continuous end-to-end automatic reset thermal overload; line voltage protection shall be provided with each individual baseboard heater to protect from overheating due to any cause. Baseboard unit shall be furnished complete, factory prewired and ready to receive branch circuit and connections. Each heater shall be provided with a factory-installed safety disconnect switch or circuit breaker installed in the housing or in an auxiliary matching control section or have thermostat with positive off position.

- B. Electric fan heaters shall be surface mounted and shall have wattage, voltage, phase, BTU/hr output and mounting as shown on the drawings or as specified. Provide surface mounted unit where there is exposed structure and no ceiling. Provide recess mounted unit where there is a ceiling. Coordinate ceiling locations and types with architectural drawings. The complete unit shall comply with the requirements of the Underwriters

Laboratories, Inc., and the requirements hereinafter specified. Ceiling heater shall be a self-contained, factory assembled fan forced heating unit and shall consist generally of heating elements, fans, driving motor, motor switch, and casing with inlet and outlet grilles. Each complete heater shall be provided with terminals for control circuits as necessary and for a single source of power supply. Sound rating of unit heaters shall be classification I or II in accordance with the Air Moving and Conditioning Association standards. Heater shall be provided with built-in disconnect switch. Heaters shall have remote mounted tamper-proof thermostat. Heaters shall be Markel Model 3470, Q Mark, Raywall, or approved equal complete with UL label.

230512 CONTROLS

- A. See Section 23 09 00 Instrumentation & Control for HVAC.

230513 MANUAL AND MOTOR OPERATED DAMPERS

- A. Manual and Motorized dampers shall be low leakage type provided in the duct systems as indicated on the drawings in accordance with NFPA Standard No. 90A and shall conform to NFPA Standard No. 90A for materials and workmanship. Blades shall have extruded vinyl double edge seals. Jams shall have flexible metal compression type seals. Maximum damper leakage at 1.0 in w.g. shall be 10 cfm/sf of damper area for motorized dampers. For manual dampers, maximum damper leakage at 1.0 in w.g. shall be 40 cfm/sf of damper area for dampers smaller than 24 inches in either dimension, and shall be 20 cfm/sf for larger manual dampers. Leakage ratings shall be when tested in accordance with AMCA Standard 500. The dampers shall have electric operators and shall be normally closed. Wiring to operators shall be by the Heating and Air Conditioning Contractor. To facilitate service access and insulation installation, manual damper handles shall be on 2" stand-off brackets. Handles shall be spray painted red. Dampers shall be installed according to the manufacturer's recommendations. Dampers shall be Ruskin, Pottorff, Prefco, Air Balance, United Enertech, or approved equal.

230514 ELECTRICAL

- A. Electrical circuit sizes are based on capacities of the drawings and it shall be the responsibility of Heating and Air Conditioning Contractor to change any and all electrical work in order to fit mechanical equipment. Heating and Air Conditioning Contractor shall coordinate with Electrical Contractor to assure that all units are properly connected and shall check wiring prior to starting units. Any damage to units resulting from improper wiring or connections shall be the responsibility of Heating and Air Conditioning Contractor. Flexible electrical conduits shall be 18 inches in length maximum. All electrical work shall be installed in accordance with codes having jurisdiction and the Electrical Division, Division 26, of these specifications.

230515 DUCTWORK

- A. Mechanical drawings are schematic only and do not show all offsets etc. required. Heating and Air Conditioning Contractor shall familiarize himself with the complete contract documents and site conditions before fabricating ductwork. Any changes to ductwork found necessary to accommodate the conditions at the building shall be made without additional cost to the Owner, and as directed by the Engineer.

- B. During construction, interior of ductwork shall be protected. All open ends of ductwork shall be covered with self-adhesive 3 mil polyethylene film.
- C. Ductwork shall be of galvanized steel with standard gauges and construction in accordance with the recommendations of SMACNA HVAC Duct Construction Standards, Metal and Flexible, Third Addition, 2005 for appropriate pressure class. Elbows shall be long radius type or have airfoil turning vanes with 1-1/8" spacing and rail support system in all 90° square throat elbows. Ductwork shall be cross broken on all sides and shall be supported at both ends of each joint and at 10'-0" intervals maximum with galvanized angles supported by galvanized threaded rods of sizes and spacing in accordance with SMACNA. Ductwork to be exposed shall be constructed in a first class, neat, professional manner and exposed ductwork with excessive hammer marks shall be replaced. Round supply takeoffs from trunk ducts shall be made with factory 45° entry branch rectangular to round type fittings. Provide dampers in takeoff fittings where indicated on drawings. Damper handles shall be on 2" stand-off brackets. Handles shall be spray painted red. Splitter dampers shall be provided where indicated with adjustment quadrant locking device and shall be constructed of two thicknesses of 24-gauge-galvanized steel. All dimensions on the drawings are free inside dimensions. All components of the air distribution system shall be mechanically fastened with at least three equally spaced sheet metal screws with screws not more than on 12" centers. All duct joints shall be sealed in accordance with SMACNA Seal Class A before insulation is applied. All sealants shall meet the provisions of UL181.
- D. Final 5'-0" of the runout to the air outlet may be factory fabricated flexible ducts complying with NFPA Standard No. 90A, UL 181, and shall be UL Class 1 R-6 insulated type with foil vapor barrier. The flexible duct shall be air tight for factory test when bent to full recommended radius and under not less than 10" water gauge internal pressure and shall be limited to 5'-0" maximum length. Flexible ducts shall be supported by galvanized steel straps in accordance with SMACNA at intervals not exceeding 4'-0" and at each change of direction. Flexible ducts shall have a minimum of one support.
- E. Dryer Vent Box shall be fully recessed unit with duct connection, flexible duct and frame as detailed on drawings. Unit shall be modified as necessary for installation in a masonry or stud wall. Dryer ductwork shall be round 30 gauge galvanized steel with substantially airtight joints and shall connect to box outlet. Sheetmetal screws shall not be used at joint connections. Joints shall run in direction of airflow. Provide cleanout at base of vertical risers. Outlet shall be non-screened aluminum with backdraft damper.

230516 PIPING

- A. The Heating and Air Conditioning Contractor shall furnish all piping and supports necessary to provide a complete system as shown or intended by the plans and specifications. All piping shall be inspected, tested, and approved before being insulated or concealed. Piping 2" and smaller shall be welded or have screwed fittings with extra heavy nipples, unless otherwise noted. Piping 2-1/2" and larger shall have welded fittings of the same material and weight as the piping in which they are installed. Pipe shall be clean, run generally parallel to the building and have all open ends closed with iron caps at all times. Eccentric reducers shall be used in horizontal runs and concentric reducers in vertical runs. All piping and fittings shall have manufacturer's identification and ASTM designation incorporated thereon.

- B. Drain pan condensate and pumped condensate piping above slab shall be Type M copper with all joints soldered with 95-5 solder where interior. Piping shall have dielectric union at connection to ferrous pipe. On building's exterior, condensate piping shall be Schedule 40 PVC with solvent cemented joints. Drain pan condensate piping shall have a minimum slope of 1/4" per linear foot, and shall be at least as large as unit condensate connection.
- C. Refrigerant piping shall be capped and dehydrated Type "L" hard drawn copper with wrought fittings. All joints shall be brazed with silver brazing alloys according to manufacturer's published recommendations.
- D. Welding material and labor shall be in accordance with welding procedures of the American Standards Code for Pressure Piping ASA B31.9. Welders shall be fully qualified in above specified procedure, tested, and so certified by an approved Welding Bureau of Locally Recognized Testing Authority. Welding shall be electric arc or oxyacetylene welding method as approved using electrodes and rods that comply with ASTM specifications.
- E. Swing joints or loops shall be provided wherever necessary to allow for expansion of piping. Broken piping or fittings shall be removed and replaced at the Heating and Air Conditioning Contractor's expense.

230517 PIPE HANGERS

- A. All piping shall be neatly and securely supported by hangers from fire resistance rated structural elements of the building spaced in the following manner:
 - 1. Copper Piping 1-1/4" and smaller - 6'-0" O.C.
 - 2. Copper Piping 1-1/2" and larger - 10'-0" O.C.
 - 3. PVC Piping - 4'-0" O.C.
 - 4. Provide 2 hangers at each change in direction.
- B. Hangers shall be the Clevis type as manufactured by Modern Fig. 590, B-Line Fig. B 3100, or Grinnell Fig. 260 complete with hanger rods of size to conform to the type of hanger and pipe supported. Hangers shall be attached to the building by beam clamps or bolted to bar joist. At hangers provide 16" long 16 gauge galvanized sheet metal protection saddle three times the nominal pipe diameter. Under no condition shall hangers be connected directly to insulated pipe. Saddles shall be Modern Type A, B-Line Fig. B 3151, or Grinnell Fig. 167.
- C. Hangers for vertical piping shall be riser clamp design as manufactured by Modern Fig. 500, B-Line Fig. B3373 or Grinnell Fig. 261. Riser clamps shall be installed on top of each floor penetration.
- D. Condensate and refrigerant piping on roof shall be supported by EPDM rubber bases with adjustable height integral pipe securement. Support shall be OMG PGM, PGS, PGTS -BK or approved equal. Walk pads under each support shall be appropriate for roof per roof's warranty requirements.

230518 INSULATION

- A. All piping and ductwork shall be inspected and tested before insulation is applied. All insulation shall meet UL 723 and ASTM-E84 flame spread and smoke developed requirements of 25/50 and shall comply with NFPA 90A and the latest edition of the NC Building Code. Insulation shall be Certainteed, Owen Corning, Knauf, and Johns-Manville.
- B. All air conditioning supply, return, and outside air ducts concealed above a ceiling and the back of all diffusers and grilles shall be externally insulated with 2" thick 1 lb. density foil scrim kraft jacketed insulation. Adhere insulation to duct with fire retardant adhesive in sufficient quantities to prevent sagging. Ducts with a width over 30" shall be further secured on all sides with mechanical fasteners on 18" maximum centers. Insulation shall be butted with facing overlapping all joints at least 2" and sealed with fire retardant vapor barrier adhesive. Tape all joints, breaks, punctures, and any penetrations with SMACNA foil faced kraft duct tape.
- C. Where externally insulated ductwork is supported by angles, provide 6" long x duct width x 1-1/2" thick 6.0 pound density board insulation on bottom of duct at hanger support. External duct insulation shall be continuous around ductwork and board insulation at duct hanger. On round ducts, duct hanger shall be outside duct insulation.
- D. Air handling unit drain pan condensate piping on interior, pumped condensate piping, make-up water piping, and all refrigerant piping shall be insulated with tubular closed cell elastomeric insulation with all joints butted and cemented tight. Insulation shall have two coats of exterior protective coating on all insulation exposed on exterior. Insulation on make-up water piping and interior condensate piping shall be 1" thick. Insulation on refrigerant piping shall be 1-1/2" thick.

230519 SPECIALTIES

- A. Floor, wall and ceiling plates or escutcheons of size to fit pipe covering shall be installed where pipes pass thru finished areas and shall be chromium plated spring type as manufactured by Kenney, Connecticut Stamping and Bending Company, Dearborne or approved equal.
- B. Unions or flanges shall be provided throughout the piping system to facilitate the removal and servicing of all valves, equipment, items, etc.

230520 VIBRATION ISOLATION

- A. Equipment isolators shall be 3/4" thick bridge bearing quality neoprene ribbed or waffled on both sides. Pads shall be selected for a maximum durometer of 50 and designed for 15% deflection. Where required, steel load-spreading plates shall be incorporated between the equipment and the neoprene pad.
- B. Flexible duct connections, both at inlet and discharge of units, shall be made of 30 oz. workinglass fiber coated with neoprene, sewn together at edges and joints. These flexible connections shall withstand the operating air-pressure, shall not permit air leakage, and shall not transmit vibration.

230521 OPENINGS

- A. The Heating and Air Conditioning Contractor shall furnish all blockouts, sleeves, and openings required for his work. Pipe sleeves, where firestop penetration system allows, shall be standard weight black steel pipe and shall be provided where pipes pass through walls and floor. Sleeves through walls shall butt flush with the wall finish and shall be of sufficient size to permit passage of pipe covering through the area where pipe is installed. Sleeves through floors shall extend 3/4" above the finished floor and sealed watertight. Any penetrations of ducts through floor shall be curbed 3" high x 6" wide with concrete. Specifically inform the General Contractor as to the correct size and location of openings and sleeves to insure that they shall be cast in their proper location. Sleeves and duct opening frames shall be furnished and installed by the Heating and Air Conditioning Contractor. Failure to indicate such openings in time to avoid delaying the General Contractor shall result in the Heating and Air Conditioning Contractor providing all cutting and repairing at his own expense. Repairing shall include sealing tight around pipe sleeves and duct frames in a neat and professional manner and in accordance with the "Cutting and Patching" section of this specification.

230522 COLOR CODING/PAINTING

- A. All exposed mechanical equipment in finished areas including ductwork, piping hangers, etc., shall be painted the same color as the adjacent ceiling and walls by the General Contractor. Heating and Air Conditioning Contractor shall treat all items as necessary to receive paint.

230523 PIPE MARKERS

- A. Markers shall have wording, wording colors, and wording background in accordance with ANSI A13.1. Markers shall have letters approximately 1" high on appropriate background, flow arrows, and shall be located on the pipe at intervals not exceeding 10'-0" where in mechanical spaces and 25'-0" intervals where above ceilings. Markers shall be plastic with markers on piping completely encircling the pipe with overlap and permanent tension in the marker to grip the pipe firmly with the need of adhesives. Provide markers on all piping in the building. Wording of markers shall be as follows:
 - 1. Refrigerant.
 - 2. Condensate.

230524 NAMEPLATES

- A. All heat pumps, split systems, heaters, and power ventilators shall be furnished with engraved plastic laminated labels permanently attached to the equipment. Lettering shall be 1/2" tall. Label shall include equipment number, area served, final acceptance date, number and size of filters, number and size of belts, and capacities. Final acceptance date shall be on a separate label so as to allow equipment nameplates to be installed prior to final acceptance.
- B. Provide engraved plastic laminated or plastic tape label on ceiling grid below power ventilators located above ceilings. Label text shall match the piece of equipment's identifier/symbol noted on the drawings.

- C. Provide laminated master list of all HVAC equipment with listing matching the symbol on the drawings. List shall include location by room number.

230525 PIPING PRESSURE TESTING

- A. The Heating and Air Conditioning Contractor shall make the following tests before the systems are insulated or covered by construction. The systems shall have no decrease in pressure during the test periods. All system components shall be protected from test pressures that exceed manufacturer's design limits.
- B. Notify Architect, Engineer, and Commissioning Authority 48 hours in advance of all tests.
- C. Heating and Air Conditioning Contractor shall provide written report of each test.
- D. Refrigerant piping shall be tested in accordance with Chapter 11 of the North Carolina Mechanical Code and split system unit manufacturer's recommendations.
- E. Condensate piping shall be tested by applying a hydrostatic pressure of 100-psig for a period of two hours.
- F. No caulking of joints shall be permitted. Any joint found to leak under this test shall be broken, remade, and a new test applied. Welded joint pinhole leaks shall be repaired by welding; however, welds that show numerous pinholes shall be replaced.

230526 SEISMIC RESTRAINTS

- A. The Heating and Air Conditioning Contractor shall be responsible for providing restraints to resist the earthquake effects on mechanical system components per the requirements found in Section 1613 of the North Carolina Building Code. All tables and references shall conform to building's location. Restraints shall be per Seismic Design Category C. Coordinate all requirements with the Structural documents for this project.
- B. The Heating and Air Conditioning Contractor shall refer to the latest edition of the "Seismic Restraints Manual Guidelines for Mechanical Systems" published by SMACNA for guidelines to determine the correct restraints for sheet metal ducts, piping and conduit, etc. This manual refers to Seismic Hazard Level (SHL).
- C. The anchorage of the equipment and machinery for this project shall be an integral part of the design and specification of such equipment and machinery. Manufacturers of all equipment including unit ventilators, chiller, air handling units, pumps, boilers, tanks, compressors, etc. shall provide anchorage details, isolators, seismic mounts and restraints, etc. necessary to comply with Section 1613 to the Heating and Air Conditioning Contractor for installation. It shall be the Heating and Air Conditioning Contractor's responsibility to provide and install the equipment, machinery, systems, and assemblies, etc. for this project that satisfy these requirements. Where seismic restraints are required, the Heating and Air Conditioning Contractor shall provide restraints per details and instructions included in SMACNA's Seismic Restraints Manual. The Heating and Air Conditioning Contractor shall include shop drawings of the specific methods of seismic restraint to be used for this project before installation of piping, ductwork, and equipment.

- D. The Heating and Air Conditioning Contractor shall retain the services of a Professional Engineer registered in the State of North Carolina to design seismic restraint elements required for this project. The Engineer's computations, bearing his professional seal, shall accompany shop drawings that show Code compliance including certification that the seismic system components comply with the testing requirements of North Carolina Building Code Chapter 17. Computations and shop drawings shall be submitted for review prior to the purchasing of materials, equipment, systems, and assemblies.
- E. Internal seismic restraint elements of manufactured equipment shall be certified by a professional engineer retained by the manufacturer. Such certificate applies only to internal elements of the equipment. All equipment anchorage requirements shall be coordinated with the building structure and shall be compatible thereto. All such anchorage shall be reviewed by the project's structural engineer.
- F. The Professional Engineer retained by the Heating and Air Conditioning Contractor for seismic restraint calculations shall visit the job site as necessary to comply with the Special Inspections requirement of the Code. This engineer shall provide in writing verification of compliance of the installation with the approved seismic submittal. This verification shall be submitted as a Special Inspections Report and shall bear the Engineer's professional seal. Job site inspections by other than this engineer are not acceptable.
- G. Review of the seismic design and shop drawings by the Engineer/Architect or his agent shall not relieve the Heating and Air Conditioning Contractor of his responsibility to comply with the seismic or any other requirements of the North Carolina Building Code.

230527 TESTING AND BALANCING

- A. Testing and balancing of the heating, ventilating, and air conditioning systems shall be performed by an AABC certified Test and Balance Company as a subcontractor to the Heating and Air Conditioning Contractor. All instruments used shall be accurately calibrated and in good working order. The tests shall be in strict accordance to the Standards of AABC. Test and Balance Contractor shall submit TAB plan to the Engineer and Commissioning Authority for their review and approval prior to starting any TAB work.
- B. Air balance and testing shall not begin until the systems have been installed in full working order and shown to be operating satisfactory on both heating and cooling. The Contractor shall place all heating, ventilating, and air conditioning systems into full operation and shall continue operation of the system until balancing is completed. All operational cost shall be borne by the Heating and Air Conditioning Contractor. The Architect and Engineer shall be given three weeks advance notice of when tests are to be made.
- C. Upon completion of the heating, ventilating, and air conditioning systems, the Test and Balance Contractor shall compile the test data and submit four copies of the completed test data to the Engineer for evaluation and approval. At final inspection and prior to final commissioning verification, Heating and Air Conditioning Contractor shall have a copy of test and balance report and all necessary personnel and equipment to facilitate spot-checking of test and balance data by the Engineer or his representative. Final

payment to the Contractor shall be withheld until the complete test and balance data has been approved.

D. Testing Procedure (AIR):

1. Test and adjust air handling unit fan's RPM and CFM to design requirements. Record all data.
2. Adjust all main supply, exhaust, return, relief, and outside air ducts to proper design CFM when air handling systems are in normal operating mode. Record exhaust, relief, and outside air data.
3. Test and adjust each diffuser, grille, and register for supply, exhaust, or return systems to within 10% of design requirements. Record all data.
4. All adjustments to air diffusing devices where possible shall be made in trunk or run out dampers, not at diffuser volume control.
5. Exhaust fans shall be tested and balanced for the requirement as shown on the plans. Record all data.
6. The Heating and Air Conditioning Contractor shall make any changes in the pulleys, belts, filters, dampers, or valves necessary or as recommended by the Engineer for correct balance at no additional cost to the Owner.

230528 INSTRUCTIONS/TRAINING

- A. The Heating and Air Conditioning Contractor shall give an instruction and training period in the operation of the apparatus to the persons who will be in charge of the system. See Section 017900 for listing and training requirements.

230529 MAINTENANCE DATA

- A. The Heating and Air Conditioning Contractor shall furnish two weeks prior to Final Acceptance and deliver to the Owner's representative on the job multiple copies of complete data as prepared by the manufacturer covering the details of operation and maintenance and complete parts list for all equipment specified. Each copy of the maintenance data shall be assembled into a 3-ring hardback binder with indexing and label on cover and spine. Data shall include:
1. Index with page numbers.
 2. List of all subcontractors and suppliers with names, addresses, and phone numbers.
 3. Contractor's certificate of Final Acceptance.
 4. Copy of all warranties.
 5. Equipment model numbers, etc. indicated and referenced with the same mark as shown on equipment on the drawings.
 6. Filter schedules of sizes and quantities for all equipment requiring filters referenced by mark on the drawings.
 7. Equipment summary showing all capacities and ratings.
 8. Certified test and balance report.
 9. Start-up and test reports for equipment.
 10. Complete start-up, operation, and shut-down procedures for each system.
 11. Lubrication schedules and types of lubricates.
 12. All submittal data and shop drawings, unless included in a separate manual.
 13. See Section 017823 for additional requirements.

230530 RECORD DRAWINGS

- A. In accordance with Section 017839 Project Record documents, the Heating and Air Conditioning Contractor shall maintain "during the course of the work" a set of specifications and drawings marked up to show the work as installed, **including a minimum of two dimensions to indicate locations and elevations of buried work.** Upon completion of the work, return this set of drawings to the Architect.

230531 GUARANTEE

- A. The Heating and Air Conditioning Contractor shall guarantee the entire heating and air conditioning system subject to the General Conditions of these specifications, except where additional or extended warranty requirements are noted elsewhere in the articles within Section 230500:
 - 1. Refrigeration compressors for heat pumps, split systems, and dedicated outside air units shall have a four-year extended warranty for the compressors only. Labor, freight, refrigerant, and other required parts shall be provided or paid for by the Owner.
 - 2. Heat exchangers for dedicated outside air units shall carry a ten-year warranty.

END OF SECTION 230500

SECTION 230900 - INSTRUMENTATION AND CONTROL FOR HVAC

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 DESCRIPTION OF WORK

- A. Furnish and install an electric control system to fulfill the intent of the drawings and specifications. The systems shall include all necessary labor, electrical wiring, controllers, programmable thermostats, devices, and materials for a complete installed control system. The control system shall be erected, assembled, and installed by factory-trained mechanics regularly employed by the control manufacturer or manufacturer's authorized distributor as a subcontractor to the Heating and Air Conditioning Contractor. All equipment, unless specified to the contrary, shall be fully proportional and shall be the product of the control manufacturer.
- B. Controls shall be programmable thermostats without interconnection to a central control system, other buildings on the site, or web-access.
- C. The control diagrams indicated on the drawings or specified herein show the intended sequences of operation of the various control systems and shall be followed as closely as practicable. All required devices and control schemes may not be shown on the drawings. It is the Contractor's responsibility to provide all devices and control schemes whether shown or not.
- D. Additional General Requirements for Controls:
 - 1. All wiring, conduit, and panels for all temperature controls.
 - 2. Power required for controls shall be provided by the Controls Contractor from points coordinated with the Electrical Contractor.
 - 3. Perform all wiring in accordance with all local and national codes and Division 26 of these specifications.
 - 4. Surge transient protection shall be incorporated in the design of the system to protect electrical components in all system components as described below under "General Product Description."
 - 5. System modifications necessary to fine-tune sequences during commissioning of systems at no additional cost to the Owner.
 - 6. Mount control devices inside of a UL-listed steel enclosure panel, with hinged locking cover and key locking latch.
- E. Wiring and Controls:
 - 1. Control Contractor shall be responsible for the installation and wiring of temperature controls, control interlock wiring, electrical controls and devices in the temperature control system.

1.3 QUALITY ASSURANCE AND STANDARDS

- A. Materials and equipment shall be the cataloged products of manufacturers regularly engaged in production and installation of integrated control systems and shall be manufacturer's latest standard design that complies with the specification requirements.
- B. All products used in this project installation shall be new and currently being manufactured. This installation shall not be used as a test site for any new products. Spare parts shall be available for at least five years after completion of this contract.
- C. Install system using competent workmen who are fully trained in the installation of integrated control systems.
- D. Single source responsibility of Contractor shall be the complete installation and proper operation of the control system and shall include debugging and proper calibration of each component in the entire system.
- E. Contractor shall have an in-place support facility within 100 miles of the site with technical staff, spare parts inventory and all necessary test and diagnostic equipment.
- F. The Contractor and manufacturer representative shall support the installed system for a minimum of 1 year. The support shall provide full material warranty of controllers and 8 hours of on-site training.
- G. All electronic equipment shall conform to the requirements of FCC Regulation, Part 15, Section 15, governing Radio Frequency Electromagnetic Interference and be so labeled.
- H. Design and build all system components to be fault-tolerant.
 - 1. Satisfactory operation without damage at 110% and 85% of rated voltage and at plus 3-Hertz variation in line frequency.
 - 2. Static, transient and short-circuit protection on all inputs and outputs.
 - 3. Protect communication lines against incorrect wiring, static transients and induced magnetic interference.
 - 4. Network-connected devices to be A.C. coupled or equivalent or that any single device failure will not disrupt or halt network communication.
 - 5. All real time clocks and data file RAM to be battery-backed for a minimum 72 hours and include local and system low battery indication.
 - 6. All programs shall retain their memory for a minimum of 7 days upon loss of power.
- I. Comply with NFPA 90A, Standard for Installation of Air Conditioning and Ventilating Systems.
- J. Provide wiring in accordance with NEC requirements and Division 26 of these Specifications.

1.4 SUBMITTALS

- A. Product Data: Submit copies of manufacturer's technical product data for each control device furnished. Indicate dimensions, capacities, performance, electrical characteristics, material finishes; also include installation and start-up instructions.

- B. Shop Drawings: Submit copies of shop drawings for each control system, containing at least the following information:
 - 1. Schematic flow diagram of system showing fans, pumps, coils, dampers, valves, control devices and all interconnections between devices.
 - 2. Indicate all required electrical wiring. Clearly differentiate between portions of wiring that are factory-installed and portions to be field-installed.
 - 3. Written description of sequence of operation.
- C. Number of copies of Product Data and Shop Drawings shall be per Division 1 of these Specifications.

1.5 DELIVERY, STORAGE AND HANDLING

- A. Provide equipment and control devices in factory shipping carton. Maintain in cartons while shipping, storing and handling as required to prevent equipment damage and to keep dirt and moisture from equipment. Store equipment and materials inside and protect from weather.

PART 2 - PRODUCTS

2.1 PRODUCTS

- A. Building controls, controllers, and communications between devices shall be provided as necessary to achieve specified sequences of operation.
- B. Room heating and cooling thermostats shall be programmable, low voltage, automatic changeover, dual setpoint type with battery backup, key pad lockout, temporary program override, temperature warmer/cooler adjustment, and night temperature setback control. Thermostat shall have heat anticipation, fan on-off switch, multi-stage cooling control and multi-stage heating control to match units controlled, and all capabilities to satisfy the sequences of operation as specified.
- C. Motorized control dampers that will not be integral to the equipment shall be furnished by the Control System Contractor. See Section 230500 for specification of motorized control dampers.
- D. Control damper actuators shall be furnished by the Control System Contractor. Two-position or proportional electric actuators shall be direct-mount type sized to provide a minimum of 5 in-lb torque per square foot of damper area. Damper actuators shall be spring return type. Operators shall be heavy-duty electronic type for positioning automatic dampers in response to a control signal. Motor shall be of sufficient size to operate damper positively and smoothly to obtain correct sequence as indicated. All applications requiring proportional operation shall utilize truly proportional electric actuators.
- E. Duct-Mounted Temperature Sensors: 20,000-ohm thermistor temperature sensors with an accuracy of $\pm 0.2^{\circ}\text{C}$. Outside air sensors shall include an integral sun shield. Duct-mounted sensors shall have an insertion measuring probe of a length appropriate for the duct size, with a temperature range of -40 to 160 degrees F. The sensor shall include a utility box and a gasket to prevent air leakage and vibration noise. For all mixed air

and preheat air applications, install bendable averaging duct sensors with a minimum 8 - foot long sensor element. These devices shall have accuracy of 0.5 degrees, F., over the entire range.

- F. Humidity sensors shall be thin-film capacitive type sensor with on-board nonvolatile memory, accuracy to plus or minus two percent (2%) at 0 to 90% RH, 12 - 30 VDC input voltage, analog output (0 - 10 VDC or 4 - 20mA output). Operating range shall be 0 to 100% RH and 32 to 140 degree F. Sensors shall be selected for wall, duct or outdoor type installation as indicated. Duct mounted sensors shall have LCD display.
- G. Current Sensitive Switches: Solid state, split core current switch that operates when the current level (sensed by the internal current transformer) exceeds the adjustable trip point. Current switch to include an integral LED for indication of trip condition and a current level below trip set point. Manufacturer: Veris, or approved equivalent.
- H. Relays: Start/stop relay model shall provide either momentary or maintained switching action as appropriate for the motor being started. All relays shall be plugged in, interchangeable, mounted on a subbase and wired to numbered terminals strips. Relays installed in panels shall all be DPDT with indicating lamp. Relays installed outside of controlled devices shall be enclosed in a NEMA enclosure suitable for the location. Relays shall be labeled with UR symbol. RIB-style relays are acceptable for remote enable/disable.
- I. Control Power Transformers: Provide step-down transformers for all DDC controllers and devices as required. Transformers shall be sized for the load, but shall be sized for 50 watts, minimum. Transformers shall be UL listed Class 2 type, for 120VAC/24VAC operation.
- J. Line voltage protection: All control system panels that are powered by 120 VAC circuits shall be provided with surge protection. This protection is in addition to any internal protection provided by the manufacturer. The protection shall meet UL, ULC 1449, IEEE C62.41B. A grounding conductor, (minimum 12 AWG), shall be brought to each control panel.

PART 3 - EXECUTION

3.1 INSTALLATION - GENERAL

- A. Install systems and materials in accordance with manufacturer's instructions in a neat workmanlike manner.
- B. Coordinate with other trades on the project as the work progresses so that each will be aware of the extent of all work. Carefully plan all work and check for interferences before installation. No extras will be allowed for changes caused by failure to check for interferences.
- C. Provide structural supports as required for panels and control devices.
- D. Supervise installation of all control dampers.

- E. Install metering devices away from bends and elbows with minimum upstream and downstream straight distances per manufacturer's recommendations and as shown on Drawings.

3.2 CONTROL WIRING

- A. Install color-coded control wiring without splices between terminal points in accordance with National Electrical Code.
- B. Install circuits over 25 volts with color-coded No. 12 or 14.
- C. Install circuits under 25 volts with color-coded cable as recommended and approved by the manufacturer.
- D. All wiring and cable used shall be plenum rated.
- E. Wiring above hard ceilings, in walls, or where exposed including in mechanical rooms shall be in 3/4" minimum EMT conduit with steel-plated hexagonal compression connectors. Wiring above lay-in ceilings may be installed as properly supported cable. Flexible metallic conduit shall be 1/2" minimum in size and not exceed 3'-0" in length.
- F. All wiring in floor slabs or on exterior shall be run in rigid conduit.

3.3 TESTING

- A. When installation of the control system is complete, calibrate equipment and verify transmission media operation before the system is placed on-line.
- B. Provide a cross check of each control point within the control system by making a comparison between the control command and the field-controlled device.
- C. Replace any work found defective. After replacement, repeat test.

3.4 START-UP AND DEMONSTRATION

- A. After completion and testing of the installation, regulate, adjust and service as necessary all control devices in the systems, placing each item in complete and proper operation.
- B. Demonstrate all systems to Owner, Architect and Engineer, and that all are operable from local controls in the specified failure mode upon electronic control system failure or loss of power.
- C. Complete all commissioning requirements as necessary to this scope of work.

3.5 INSTRUCTION

- A. Provide the services of manufacturer's technical personnel for 8 hours of instruction to Owner's personnel in the operation, maintenance and programming of the control system. Orient the training specifically to the system installed rather than a general training course.

- B. Provide training manuals, equipment and material required for classroom training.
- C. Training to include the following items:
 - 1. Operation of equipment
 - 2. Programming
 - 3. Diagnostics
 - 4. Failure recovery procedures
 - 5. Alarm formats (where applicable)
 - 6. Maintenance and calibration
 - 7. Trouble shooting, diagnostics, and repair instructions

PART 4 - POINTS LISTS AND SEQUENCES OF OPERATION

4.1 SUMMARY

- A. The drawings indicate the individual types of systems and the points required in each system.
- B. System sequences of operation shall be as indicated on the drawings and as specified herein.

END OF SECTION 230900

SECTION 260000 – ELECTRICAL, BASICS

1.1 RELATED DOCUMENTS

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

1.2 GENERAL

- A. Applicable requirements of the Instructions to Bidders and General Conditions of the Contract shall be a part of the Electrical Specifications. The electrical contractor shall examine the general and special conditions before submitting a proposal.
- B. The electrical work shall be performed by a licensed electrical contractor.
- C. The electrical contractor shall assume total responsibility for any portion of the work provided by his subcontractors.

1.3 CODES AND STANDARDS

- A. Building Codes:
 - 1. National Fire Protection Association No. 70, National Electrical Code
 - 2. North Carolina State Building Code, Latest Edition and Revisions (NCSBC)
 - 3. National Electrical Safety Code (NESC)
 - 4. National Bureau of Standards (NBS)
 - 5. Local Codes where applicable
- B. Industry Standards:
 - 1. Underwriter's Laboratories, Inc. Standards and approved listings (UL)
 - 2. Electrical Testing Laboratories Standards (ETL)
 - 3. National Electrical Manufacturers Association Standards (NEMA)
 - 4. Insulated Power Cable Engineers Association Standards (IPCEA)
 - 5. American National Standards Institute (ANSI)
 - 6. American Society for Testing Materials Standards (ASTM)
 - 7. Canadian Standards Association (CSA)

1.4 SCOPE OF WORK

- A. It is the intent and meaning of the drawings and specifications to call for finished work that has been tested and is ready for operation. The electrical contractor shall take this into consideration and include in his proposal allowance for contingencies that will allow him to provide minor pieces of materials and labor not specifically indicated but required for the job to operate properly. This paragraph is intended to insure a complete job will be provided without requests for minor extras.

1.5 RECORD DRAWINGS

- A. A set of drawings covering the electrical contract will be provided to the electrical contractor to mark all changes, modifications, or revisions effected during construction. These field mark-up drawings are to be turned over to the electrical designer.
- B. The electrical contractor shall provide photographs of switchboards and panelboards. Photographs shall clearly show equipment designations, manufacturer nameplates, breaker positions, breaker ratings, and directory descriptions.

1.6 APPROVAL OF MATERIALS

- A. See project manual contract documents for pre-bid substitution requirements.
- B. Construction phase: The CONTRACTOR shall submit his proposal on the specified materials and equipment, or their equivalent, provided the words "or equal" or "or approved equal" follow the named manufacturers. If the above phrases do not appear, the specified manufacturers shall be furnished without substitution. Equivalent shall be interpreted to mean an item of material or equipment, similar to that named and which is suitable for the same use and capable of performing the same functions as that named, the Architect / Landscape Architect and/or Engineer being the judge of equality.
- C. Where no specific material or equipment type is mentioned, any first-class product of a reputable manufacturer may be used provided it conforms to the requirements of the specifications. These materials shall be third party listed or labeled in accordance with the General Statutes of the State (example: UL, ETL, CSA, etc.).

1.7 SHOP DRAWINGS AND SUBMITTAL DATA PROCEDURES

- A. Unless directed otherwise in the Project Manual or General Provisions and/or Conditions of the Contract, the CONTRACTOR shall submit PDF files of shop drawings, certified prints, literature, coordination drawings, and cut sheets to the Architect / Landscape Architect and/or Engineer for all major items of equipment and materials for review and approval. It is preferred that all electrical submittals for the project shall be submitted at one and the same time.
- B. Product data cut sheets with multiple components, part numbers, etc. shall be clearly marked to identify what is proposed for this project.
- C. The CONTRACTOR shall analyze all shop drawings and submittal data and certify that they meet requirements of Contract Drawings and Specifications, prior to delivery to the Architect / Landscape Architect and/or Engineer. CONTRACTOR Certification shall be in the form of suitable approval stamp placed on each shop drawing submitted for approval.
- D. If the Architect / Landscape Architect and/or Engineer deems submittal data is either incomplete or incorrect, a resubmittal submittal will be required.

- E. At least one set of all “approved” shop drawings, certified prints, etc., shall be maintained at the job site and available to representative of the Architect / Landscape Architect and/or Engineer.
- F. Approval by the Architect / Landscape Architect and/or Engineer of shop drawings for any materials, apparatus, devices, and layouts shall not relieve the CONTRACTOR from the responsibility of furnishing same of proper dimensions, size, quantity, quality and all performance characteristics to efficiently perform the requirements and intent of the contract documents. Such approval shall not relieve the CONTRACTOR from responsibility for errors of any sort on the shop drawings. If the shop drawings deviate from the Contract Documents, the CONTRACTOR shall advise the Architect / Landscape Architect and/or Engineer of the deviations in writing, accompanying the shop drawings, including the reason for the deviations.
- G. Physical sizes of equipment used in the design layout are those of reputable equipment manufacturers. The CONTRACTOR is responsible for providing equipment that will fit the space available. If the CONTRACTOR elects to use equipment that results in conflicts with space clearance or codes, it shall be the responsibility of the CONTRACTOR to correct at his expense. The CONTRACTOR shall assume responsibility for providing code clearances. Where equipment is designated for existing space, the CONTRACTOR shall make necessary field measurements to ascertain space requirements, including those for connections; and shall furnish and install such sizes and shapes of equipment that the final installation shall suit the intent and meaning of the drawings and specifications.
- H. Catalog Data for OWNER:
 - 1. The CONTRACTOR shall provide compilations of catalog data, bound in suitable loose-leaf binders, for each manufactured item of equipment used in the electrical work. These shall be presented to the Architect / Landscape Architect and/or Engineer for transmittal to the OWNER before the final inspection is made. Data shall include printed installation, operation, and maintenance instructions for each item, indexed by product with heavy sheet dividers and tabs. All warranties shall be included with each item. Each manufacturer’s name, address, and telephone number shall be clearly indicated. Generally, shop drawings and submittal data alone are not adequate for catalog data.
- I. Record Documents for OWNER:
 - 1. Conductor and cable megger test results.
 - 2. Grounding electrode system test results.
 - 3. Communications horizontal cable:
 - a. Test results.
 - b. Cable schedule.
 - c. Cable administration drawings.
 - 4. Fire alarm system:
 - a. NFPA 72 Fire Alarm System Record of Completion.
 - b. System Status and Programming Report.
 - c. System operational matrix.
 - d. Digital copy of system software on USB flash drive.

1.8 DRAWINGS AND SPECIFICATIONS

- A. The Electrical drawings and specifications are complementary each to the other, and what may be called for by one shall be as binding as if called for by both. The drawings are diagrammatic and indicate generally the location of outlets, devices, equipment wiring, etc and show the general arrangement of raceways, fixtures, and equipment. Drawings shall be followed as closely as actual building construction and the work of other trades will permit; however, all work shall suit the finished surroundings and/or trim.
- B. It shall be understood that where the words "furnish," "provide," and/or "install" are used, it is intended that this CONTRACTOR shall purchase and install completely all material necessary and required for this particular item, system, equipment, etc.
- C. Any omission from either the drawings or the specifications are unintentional, and it shall be the responsibility of the CONTRACTOR to call to the attention of the Architect / Landscape Architect and/or Engineer any pertinent omissions before submitting a proposal. Complete and working systems are required, whether every small item of material is shown and specified or not.
- D. The electrical work shall conform to the requirements shown on all of the drawings. General and Structural drawings shall take precedence over Electrical Drawings. Because of small scale of the electrical drawings, it is not practical to indicate offsets, fittings and accessories that may be required. The CONTRACTOR shall investigate the structural and finish conditions affecting the work and shall arrange his work accordingly, providing such fittings and accessories as may be required to meet such conditions, without additional cost to the OWNER and as directed by the Architect / Landscape Architect and/or Engineer.
- E. Load circuits shall be installed as indicated on the drawings. Circuit number revisions will not be accepted unless approved in writing by the Engineer.

1.9 COORDINATION OF WORK

- A. It is understood and agreed that by submitting a bid, the CONTRACTOR has, by careful examination, satisfied himself as to the nature and location of the work, the conformation of the ground, the character, quality and quantity of the materials to be encountered, the general and local conditions and all other matters which can and may affect the work under this contract. The CONTRACTOR shall be held responsible for visiting the site and thoroughly familiarizing himself with the existing conditions and also any contractual requirements as may be set forth in the other divisions of these specifications. No extras will be considered because of additional work necessitated by obvious job conditions that are not indicated on the drawings.
- B. The CONTRACTOR shall compare the electrical drawings and specifications with the drawings and specifications for other trades and shall report any discrepancies between them to the Architect / Landscape Architect and/or Engineer and obtain from him written instructions for changes necessary in the electrical work. The electrical work shall be installed in cooperation with other trades installing interrelated work. Before installation, the CONTRACTOR shall make proper provisions to avoid

interferences in a manner approved by the Architect / Landscape Architect and/or Engineer. All changes required in the work of the CONTRACTOR caused by his neglect to do so shall be made by him at his expense.

- C. Location of electrical raceways, switches, panels, equipment, fixtures, etc., shall be adjusted to accommodate the work to interferences anticipated and encountered. The CONTRACTOR shall determine the exact route and location of each electrical raceway prior to make up and assembly.
- D. Right-of-Way: Lines which pitch shall have the right-of-way over those which do not pitch. For example, steam, condensate and plumbing drains shall normally have right of way. Lines whose elevations cannot be changed shall have the right of way over lines whose elevations can be changed.
- E. Offsets and changes in direction of electrical raceways shall be made as required to maintain proper headroom and to clear pitched lines whether or not indicated on the drawings. The CONTRACTOR shall furnish and install elbows, pull boxes, etc., as required to affect these offsets, transitions, and changes in directions. Conflicts between electrical raceways, fixtures, etc., and ductwork which cannot be resolved otherwise, will be resolved by the Architect / Landscape Architect and/or Engineer.
- F. The CONTRACTOR shall install all electrical work to permit removal (without damage to other parts) of any equipment requiring periodic replacement or maintenance. The CONTRACTOR shall arrange electrical raceways and equipment to permit ready access to valves, cocks, traps, starters, motors, control components, etc., and to clear the opening of swinging and overhead doors and of access panels.
- G. Electrical Work Coordinated with Other Disciplines:
 - 1. Heating, Ventilating and Air Conditioning Equipment:
 - a. The electrical contractor shall provide a source of power for all mechanical equipment. "Source" shall include conductors, raceways, circuit breakers, junction boxes, panelboards and/or wiring troughs as required by conditions and codes and/or as shown on the contract drawings.
 - b. In general, individual disconnecting means and circuitry for each mechanical equipment unit will be furnished and installed by the electrical contractor. Line side and load side connections at the disconnect shall be made by the electrical contractor. Load side wiring from the disconnect shall be installed by the EC, and equipment connections shall be made by the subMechanical Contractor.
 - 2. Plumbing Equipment:
 - a. Electric Water Coolers: As indicated on the drawings, the electrical contractor shall provide either a grounding type 120V, GFCI receptacle for power supply at each electric water cooler, or the branch breaker supplying a grounding type 120V receptacle shall be GFCI type. The electrical contractor shall consult the Plumbing Contractor to determine the exact outlet location required before roughing in. All outlets and cords shall be concealed within the cabinet.

- b. Water Heaters: The electrical contractor shall provide a disconnect adjacent to the water heater as a source of power. Circuitry from the disconnect to the water heater shall be provided by the electrical contractor. Final connections shall be provided by the contractor providing the equipment.
- c. Hot Water Circulating Pump: See drawing detail. The plumbing contractor will provide an "Aquastat". The remainder of devices and equipment shall be provided by the electrical contractor.

H. Equipment and Materials (General):

- 1. Materials shall be new and shall bear the manufacturer's name, trade name, and listing label in every case where a standard has been established for the particular material. The equipment to be furnished under this specification shall be essentially the standard product of manufacturers regularly engaged in the production of the required type of equipment and shall be the manufacturer's latest approved design.
- 2. Electrical motors shall meet the minimum efficiency requirements of applicable tables in the North Carolina Energy Conservation Code.
- 3. Delivery and Storage:
 - a. Store products to allow for inspection and measurement of quantity or counting of units.
 - b. Store products that are subject to damage by the elements, under cover in a weathertight enclosure above ground, with ventilation adequate to prevent condensation.
 - 1) Electrical equipment shall be delivered to the site and stored in original containers. Store protected from the elements, but readily accessible for inspection by the Architect and/or Engineer until installed. Equipment shall be tightly covered and protected against dirt, water and chemical or mechanical injury and theft. Corrosion inhibitors shall be installed in all panelboards, switches, starters and control panels immediately upon receipt. Install one inhibitor for every 8 cubic feet of enclosure volume. Replace inhibitors every 90 days and at final inspection in the ARCHITECT AND/OR ENGINEER's presence. Rusty and/or corroded materials and equipment will be replaced at the direction of the Architect and/or Engineer.
 - 2) Rusty and/or corroded materials and equipment will be replaced at the direction of the Architect / Landscape Architect and/or Engineer.
 - c. Comply with product manufacturer's written instructions for temperature, humidity, ventilation, and weather-protection requirements for storage.
 - d. Protect stored products from damage.
- 4. Equipment and materials of the same general type shall be of the same make throughout the work to provide uniform appearance, operation and maintenance.
- 5. At the completion of the work; fixtures, equipment, and materials shall be cleaned and polished thoroughly and turned over to the OWNER in a condition satisfactory to the Architect / Landscape Architect and/or Engineer. Damage or defects, developing before acceptance of the work shall be corrected at the CONTRACTOR's expense.

6. Manufacturer's directions shall be followed completely in the delivery, storage, protection, and installation of all equipment and materials. The CONTRACTOR shall promptly notify the Architect / Landscape Architect and/or Engineer, in writing, of any conflicts between any requirements of the Contract Documents and the manufacturer's directions and shall obtain the Architect / Landscape Architect and/or Engineer's written instructions before proceeding with the work. Should the CONTRACTOR perform any work that does not comply with the manufacturer's instructions, recommendations, or requirements; it shall be corrected at the direction of the Architect / Landscape Architect and/or Engineer at no additional cost to the Owner.
- I. Sleeves, Inserts, Openings, Etc.:
1. Anchor bolts, sleeves, inserts, supports, etc., that may be required for electrical work shall be furnished, located, and installed by the electrical contractor. Where working under a subcontract for a General Contractor, the electrical contractor shall give sufficient information (marked and located) to the General Contractor in time for proper placement in the construction schedule. Should the electrical contractor delay or fail to provide sufficient information in time, the electrical contractor shall cut and patch construction as necessary and required to install electrical work, with finishes completed to the satisfaction of the Owner, and Architect / Landscape Architect and/or Engineer.
- J. Cutting and Patching:
1. The electrical contractor shall do all rough cutting and patching as required for the proper installation of work under this contract. Cutting shall be kept to a minimum, and finishes shall be restored to the satisfaction of the Owner, and Architect / Landscape Architect and/or Engineer.
- K. Locations and Measurements:
1. Outlets, equipment, and appliances are shown and located on the drawings as accurately as possible. All measurements shall be verified on the project and coordinated with the drawings of other disciplines. In all cases, the work shall suit the surrounding trim and/or decoration and construction. The locations of outlets for special appliances shall be installed so that when extended, they are flush with the finished wall, floor, or ceiling and permit the proper installation of fixtures, devices, equipment, appliances, etc. Heights of all outlets shown on the drawings are approximate only. Slight relocations of outlets, devices, and equipment shall be made by the electrical contractor as required or as directed by the Architect / Landscape Architect and/or Engineer at no additional cost to the OWNER.
- L. Workmanship:
1. Work shall be executed as required by the specifications and the accompanying drawings and shall be done in a workmanlike manner by skilled mechanics, and shall present a neat, trim, and mechanical appearance when completed. All work shall be performed as required by the progress of the job.
- M. Final Inspections and Equipment Demonstrations:

1. The CONTRACTOR shall acquire permits for construction & coordinate all required inspections with the office of the local electrical inspector and/or local authority having jurisdiction, if required. The CONTRACTOR shall provide the Owner two (2) copies of Electrical Inspectors' written reports.
2. The CONTRACTOR shall furnish ladders, required tools, and men to open fixtures, boxes, panels, or any other equipment to enable the Architect / Landscape Architect and/or Engineer representatives to see into any parts of the installation he may request.
3. The CONTRACTOR shall furnish meters for observation of readings as directed by the Architect / Landscape Architect and/or Engineer representative. Meters to be furnished include: clamp-on type ammeter, voltmeter, megger, and clamp-on type ground resistance tester.

N. Operating Instructions:

1. At the completion of the entire installation, the CONTRACTOR shall arrange to operate each component of systems and then systems as a whole. When all the requirements of the plans and specifications have been met, the CONTRACTOR shall then arrange to instruct the OWNER's operating and maintenance personnel in the correct and proper procedures for the operation and maintenance of the systems

END OF SECTION 260000

SECTION 260500 - BASIC ELECTRICAL MATERIALS AND METHODS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. This Section includes the following:
 - 1. Supporting devices for electrical components.
 - 2. Cutting and patching for electrical construction.
 - 3. Touchup painting.

1.3 QUALITY ASSURANCE

- A. 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.
- B. Comply with NFPA 70.

PART 2 - PRODUCTS

2.1 SUPPORTING DEVICES

- A. Material: Cold-formed steel, with corrosion-resistant coating acceptable to authorities having jurisdiction.
- B. Metal Items for Use Outdoors or in Damp Locations: Stainless steel.
- C. Slotted-Steel Channel Supports: Flange edges turned toward web, and 9/16-inch diameter slotted holes at a maximum of 2 inches o.c., in webs.
 - 1. Channel Thickness: Selected to suit structural loading.
 - 2. Fittings and Accessories: Products of the same manufacturer as channel supports.
- D. Raceway and Cable Supports: Manufactured clevis hangers, riser clamps, straps, threaded C-clamps with retainers, ceiling trapeze hangers, wall brackets, and spring-steel clamps or click-type hangers.
- E. Expansion Anchors:
 - 1. Inside: Carbon-steel wedge or sleeve type.
 - 2. Outside: Stainless-steel wedge or sleeve type.
- F. Toggle Bolts:

1. Inside: All steel springhead type.
2. Outside: Stainless-steel springhead type.

2.2 TOUCHUP PAINT

- A. For Equipment: Equipment manufacturer's paint selected to match installed equipment finish.
- B. Galvanized Surfaces: Zinc-rich paint recommended by item manufacturer.

PART 3 - EXECUTION

3.1 COORDINATION

- A. Coordinate chases, slots, inserts, sleeves, and openings with general construction work and arrange during progress of construction to facilitate the electrical installations that follow.
 1. Set inserts and sleeves in poured-in-place concrete, masonry work, and other structural components as they are constructed.
- B. Sequence, coordinate, and integrate installing electrical materials and equipment for efficient flow of the Work. Coordinate installing large equipment requiring positioning before closing in the building.
- C. Coordinate location of access panels and doors for electrical items that are concealed by finished surfaces.

3.2 ELECTRICAL EQUIPMENT INSTALLATION

- A. Headroom Maintenance: If mounting heights or other location criteria are not indicated, arrange and install components and equipment to provide the maximum possible headroom.
- B. Materials and Components: Install level, plumb, and parallel and perpendicular to other building systems and components, unless otherwise indicated.
- C. Equipment: Install to facilitate service, maintenance, and repair or replacement of components. Connect for ease of disconnecting, with minimum interference with other installations.
- D. Right of Way: Give to raceways and piping systems installed at a required slope.

3.3 ELECTRICAL SUPPORTING DEVICE APPLICATION

- A. Selection of Supports: Comply with manufacturer's written instructions.
- B. Strength of Supports: Adequate to carry present and future loads, times a safety factor of at least four; minimum of 200-lb (90-kg) design load.

3.4 SUPPORT INSTALLATION

- A. Install support devices to securely and permanently fasten and support electrical components.
- B. Install individual and multiple raceway hangers and riser clamps to support raceways. Provide U-bolts, clamps, attachments, and other hardware necessary for hanger assemblies and for securing hanger rods and conduits.
- C. Support parallel runs of horizontal raceways together on trapeze- or bracket-type hangers.
- D. Size supports for multiple raceway installations so capacity can be increased by a 25 percent minimum in the future.
- E. Support individual horizontal raceways with separate pipe hangers or clamps.
- F. Install 1/4-inch- diameter or larger threaded hanger rods, unless otherwise indicated.
- G. Spring-steel fasteners specifically designed for supporting single conduits or tubing may be used instead of hangers for 1-1/2-inch and smaller raceways serving lighting and receptacle branch circuits above suspended ceilings and for fastening raceways to slotted channel and angle supports.
- H. 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. Simultaneously install vertical conductor supports with conductors.
- I. Separately support cast boxes that are threaded to raceways and used for fixture support. Support sheet-metal boxes directly from the building structure or by bar hangers. If bar hangers are used, attach bar to raceways on opposite sides of the box and support the raceway with an approved fastener not more than 24 inches from the box.
- J. Install metal channel racks for mounting cabinets, panelboards, disconnect switches, control enclosures, pull and junction boxes, transformers, and other devices unless components are mounted directly to structural elements of adequate strength.
- K. Install sleeves for cable and raceway penetrations of concrete slabs and walls unless core-drilled holes are used. Install sleeves for cable and raceway penetrations of masonry and fire-rated gypsum walls and of all other fire-rated floor and wall assemblies. Install sleeves during erection of concrete and masonry walls.
- L. Securely fasten electrical items and their supports to the building structure, unless otherwise indicated. Perform fastening according to the following unless other fastening methods are indicated:
 - 1. Wood: Fasten with wood screws or screw-type nails.
 - 2. Masonry: Toggle bolts on hollow masonry units and expansion bolts on solid masonry units.
 - 3. New Concrete: Concrete inserts with machine screws and bolts.

4. Existing Concrete: Expansion bolts.
5. Steel: Spring-tension clamps on steel.
6. Light Steel: Sheet-metal screws.
7. Fasteners: Select so the load applied to each fastener does not exceed 25 percent of its proof-test load.

3.5 CUTTING AND PATCHING

- A. Cut, channel, chase, and drill floors, walls, partitions, ceilings, and other surfaces required to permit electrical installations. Perform cutting by skilled mechanics of trades involved.
- B. Repair and refinish disturbed finish materials and other surfaces to match adjacent undisturbed surfaces. Install new fireproofing where existing firestopping has been disturbed. Repair and refinish materials and other surfaces by skilled mechanics of trades involved.

3.6 FIELD QUALITY CONTROL

- A. Inspect installed components for damage and faulty work.

3.7 REFINISHING AND TOUCHUP PAINTING

- A. Refinish and touch up paint.
 1. Clean damaged and disturbed areas and apply primer, intermediate, and finish coats to suit the degree of damage at each location.
 2. Follow paint manufacturer's written instructions for surface preparation and for timing and application of successive coats.
 3. Repair damage to galvanized finishes with zinc-rich paint recommended by manufacturer.
 4. Repair damage to PVC or paint finishes with matching touchup coating recommended by manufacturer.

3.8 CLEANING AND PROTECTION

- A. On completion of installation, including outlets, fittings, and devices, inspect exposed finish. Remove burrs, dirt, paint spots, and construction debris.
- B. Protect equipment and installations and maintain conditions to ensure that coatings, finishes, and cabinets are without damage or deterioration at time of Final Acceptance.

END OF SECTION 260500

SECTION 260519 - CONDUCTORS AND CABLES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. This Section includes building wires and cables and associated connectors, splices, and terminations for wiring systems rated 600 V and less.

1.3 SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Field Quality-Control Test Reports: From Contractor.

1.4 QUALITY ASSURANCE

- A. 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.
- B. Comply with NFPA 70.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, provide products by the manufacturers specified.

2.2 POWER CONDUCTORS AND CABLES

- A. Manufacturers:
 - 1. Cerro Wire LLC.
 - 2. Colonial Wire and Cable.
 - 3. Encore Wire Corporation.
 - 4. General Cable Corporation.
 - 5. Okonite.
 - 6. Prysmian Group.
 - 7. Republic Wire, Inc.
 - 8. Southwire.
 - 9. Or approved equal.

- B. Refer to Part 3 "Conductor and Insulation Applications" Article for insulation type, cable construction, and ratings.
- C. Conductor Material:
 - 1. Copper complying with NEMA WC70 / ICEA S-95-658 solid conductor for No. 10 AWG and smaller, stranded for No. 8 AWG and larger.
 - 2. Power and lighting circuitry: Minimum conductor size shall be #12, and maximum conductor size shall be #500 kcmil.
- D. Conductor Insulation Types: Type THHN/THWN-2 complying with NEMA WC70 / ICEA S-95-658.

2.3 CONTROL CONDUCTORS AND CABLE

- A. Discrete control conductors: Copper, stranded, type THHN/THWN-2.
 - 1. Manufacturers: Same as Power Conductors and Cables manufacturers.
- B. Dimmer control cable: Copper, shielded pair, wet location.

2.4 CONNECTORS AND SPLICES

- A. Manufacturers:
 - 1. AFC Cable Systems.
 - 2. AMP Incorporated/Tyco International.
 - 3. FCI.
 - 4. Greaves Polaris.
 - 5. Hubbell/Anderson.
 - 6. ILSCO.
 - 7. NSI.
 - 8. O-Z/Gedney; EGS Electrical Group LLC.
 - 9. Penn Union.
 - 10. 3M Company; Electrical Products Division.
 - 11. Or approved equal.
- B. Description: Factory-fabricated connectors and splices of size, ampacity rating, material, type, and class for application and service indicated.
 - 1. For conductors #8 & smaller, use wirenut type twist connectors.
 - 2. For conductors #6 & larger, use pre-insulated solderless connectors with one spare port for future conductor connection.

PART 3 - EXECUTION

3.1 CONDUCTOR AND INSULATION APPLICATIONS

- A. Feeders, Branch Circuits: Type THHN/THWN-2, single conductors in raceway.
- B. Discrete Control Circuits: Type THHN/THWN-2, in raceway.
- C. Dimmer Control Circuits: Sshielded pair cable, in raceway.

1. #18 AWG cable for circuits up to 300' in length.
2. #16 AWG cable for circuits up to 400' in length.
3. #14 AWG cable for circuits over 400' in length.

D. Class 1 Control Circuits: Type THHN/THWN-2, in raceway.

3.2 INSTALLATION

- A. Use manufacturer-approved pulling compound or lubricant where necessary; compound used must not deteriorate conductor or insulation. Do not exceed manufacturer's recommended maximum pulling tensions and sidewall pressure values.
- B. Use pulling means, including fish tape, cable, rope, and basket-weave wire/cable grips, that will not damage cables, conductors, or raceway.
- C. Identify and color-code conductors and cables according to Section "Electrical Identification."
- D. Shared neutral conductors shall not be used unless specifically indicated so on homerun circuitry designations on the drawings.

3.3 CONNECTIONS

- A. Connect outlet and component connections to wiring systems and to ground. Tighten electrical connectors and terminals according to manufacturer's published torque-tightening values. If manufacturer's torque values are not indicated, use those specified in UL 486A and UL 486B.
- B. Make splices and taps that are compatible with conductor material and that possess equivalent or better mechanical strength and insulation ratings than unspliced conductors.
- C. Wiring at Outlets: Install conductor at each outlet, with at least 12 inches (300 mm) of slack.

3.4 FIELD QUALITY CONTROL

- A. Testing: Perform the following field quality-control testing:
 1. After installing conductors and cables and before electrical circuitry has been energized, test for compliance with requirements.
 2. Inspect for physical damage; test conductors and cable for continuity and shorts.
 3. Megger testing for building wire and cable:
 - a. All current carrying phase conductors and neutrals shall be tested as installed, and before connections are made, for insulation resistance and accidental grounds. This shall be done with a 500 volt megger. Megger testers shall not be electronic type. Megger testers shall be hand crank or power driven crank type. Minimum readings between conductors and between conductor and the grounded metal raceway shall be: 25 mega-ohms for #6 wire and smaller; 50 mega-ohms for #4 wire or larger.

- b. The CONTRACTOR shall correct malfunctioning conductors and cables, including replacement if necessary, and retest to demonstrate compliance.
 - c. Certify compliance with test parameters.
 - 4. Control / Signal Transmission Media Tests:
 - a. Test cable segments for faulty connectors, splices, terminations, and the integrity of the cable and its component parts.
 - b. Correct malfunctioning conductors and cables at Project site, where possible, and retest to demonstrate compliance; otherwise, remove and replace with new units and retest.
- B. Test Reports: Prepare a written report to record the following:
 - 1. Test procedures used.
 - 2. Test results that comply with requirements.
 - 3. Test results that do not comply with requirements and corrective action taken to achieve compliance with requirements.
 - 4. Provide tabulated megger readings for each panel circuit.
- C. Witness Tests:
 - 1. The CONTRACTOR shall furnish a megger and show A/E representative and/or Owner that the conductors and panels comply with the above requirements.

END OF SECTION 260519

SECTION 260526 - GROUNDING AND BONDING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 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.

1.3 SUBMITTALS

- A. Product Data: For the following:
 - 1. Ground rods.
 - 2. Connection / test / inspection wells.
- B. Field Test Reports: Submit written test reports to include the following:
 - 1. Test procedures used.
 - 2. Test results that comply with requirements.
 - 3. Results of failed tests and corrective action taken to achieve test results that comply with requirements.

1.4 QUALITY ASSURANCE

- A. 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.
- B. Comply with UL 467.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. Grounding Conductors, Cables, Connectors, and Rods:
 - a. Chance/Hubbell.
 - b. Copperweld.
 - c. Erico Inc.; Electrical Products Group.
 - d. Framatome Connectors/Burndy Electrical.
 - e. Galvan Industries.

- f. Harger.
- g. Heary Brothers Lightning Protection Co.
- h. Ideal Industries.
- i. ILSCO.
- j. Kearney/Cooper Power Systems.
- k. Lyncole XIT Grounding.
- l. O-Z/Gedney Co.
- m. Racor, Inc.
- n. Salisbury: W. H. Salisbury & Co.
- o. Southern Grounding / South Atlantic LLC.
- p. Thomas & Betts.
- q. Thompson Lightning Protection.
- r. Or approved equal.

2.2 GROUNDING CONDUCTORS

- A. For insulated conductors, comply with Section "Conductors and Cables."
- B. Grounding Electrode Conductors: Stranded cable.
- C. Underground Conductors: Bare, tinned, stranded, unless otherwise indicated.
- D. Bare Copper Conductors: Comply with the following:
 - 1. Solid Conductors: ASTM B 3.
 - 2. Assembly of Stranded Conductors: ASTM B 8.
 - 3. Tinned Conductors: ASTM B 33.
- E. Grounding Bus:
 - 1. Bare, annealed copper bars of rectangular cross section
 - 2. 1/4" thick, 4" wide, length as required
 - 3. Stand-off insulator mounting brackets.

2.3 CONNECTOR PRODUCTS

- A. Comply with IEEE 837 and UL 467; listed for use for specific types, sizes, and combinations of conductors and connected items.
- B. Bolted Connectors: Bolted-pressure-type connectors, or compression type.
- C. Welded Connectors: Exothermic-welded type, in kit form, and selected per manufacturer's written instructions.

2.4 GROUNDING ELECTRODES

- A. Ground Rods: Sectional type; copper-clad steel, 3/4" diameter by 120 inches in length.
- B. Connection / Test / Inspection Wells: Provide handholes as specified below:
 - 1. Cylinder, minimum dimensions of 12" diameter x 19" deep, PVC, with cover.

2. Box, minimum dimensions of 12" x 12" x 12" deep with cover, green PVC or polyethylene.

PART 3 - EXECUTION

3.1 APPLICATION

- A. In raceways, use insulated equipment grounding conductors.
- B. Exothermic-Welded Connections: Use for connections to ground rods, structural steel and for underground connections.
- C. Equipment Grounding Conductor Terminations: Use bolted pressure clamps.
- D. Grounding Bus: Install in electrical and telephone equipment rooms, in rooms housing service equipment, and elsewhere as indicated.
 1. Use insulated spacers; space 1 inch minimum from wall and support 12 inches above finished floor, unless otherwise indicated.
- E. Underground Grounding Conductors: Use tinned- copper conductor. Bury at least 24 inches below grade or bury 12 inches above duct bank when installed as part of the duct bank.

3.2 EQUIPMENT GROUNDING CONDUCTORS

- 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.
- C. Signal and Communication Systems: For telephone, alarm, voice and data, and other communication systems, provide No. 4 AWG minimum insulated grounding conductor in raceway from grounding electrode system to each service location, terminal cabinet, wiring closet, and central equipment location.
 1. Service and Central Equipment Locations and Wiring Closets: Terminate grounding conductor on a 1/4-by-2-by-12-inch grounding bus.
 2. Terminal Cabinets: Terminate grounding conductor on cabinet grounding terminal.

3.3 INSTALLATION

- A. Ground Rods: Install a minimum of two rods spaced at least twenty feet from each other and located at least the same distance from other grounding electrodes.
 1. Drive ground rods until tops are 2 inches below finished floor or final grade, unless otherwise indicated.
 2. Interconnect ground rods with grounding electrode conductors. Use exothermic welds for connections. Make connections without exposing steel or damaging copper coating.

- B. 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.
- C. Building Steel: Provide insulated copper grounding conductors, in conduit, from building's main service equipment, or grounding bus, to building steel. Connect grounding conductors to building steel by exothermic weld.
- D. Metal Water Service Pipe: Provide insulated copper grounding conductors, in conduit, from building's main service equipment, or grounding bus, to main metal water service entrances to building. Connect grounding conductors to main metal water service pipes by grounding clamp connectors. Connection shall be made within the first five feet of where the water service line enters the building. Where a dielectric main water fitting is installed, connect grounding conductor to street side of fitting. Bond metal grounding conductor conduit or sleeve to conductor at each end.
- E. Water Meter Piping: Use braided-type bonding jumpers to electrically bypass water meters. Connect to pipe with grounding clamp connectors.
- F. Ufer Ground (Concrete-Encased Grounding Electrode): Fabricate according to NFPA 70, Paragraph 250.52(A)(3), using a minimum of 20 feet of bare copper conductor not smaller than No. 4 AWG. If concrete foundation is less than 20 feet long, coil excess conductor within the base of the foundation. Bond grounding conductor to reinforcing steel in at least four locations and to anchor bolts. Extend grounding conductor below grade and connect to building grounding grid or to a grounding electrode external to concrete.

3.4 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. Coat and seal connections having dissimilar metals with inert material to prevent future penetration of moisture to contact surfaces.
- B. Exothermic-Welded Connections: Comply with manufacturer's written instructions. Welds that are puffed up or that show convex surfaces indicating improper cleaning are not acceptable.
- 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. 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.

- E. 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.

END OF SECTION 260526

SECTION 260533 - RACEWAYS AND BOXES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. This Section includes raceways, fittings, boxes, enclosures, and cabinets for electrical wiring.
- B. Related Sections include the following:
 - 1. Section "Basic Electrical Materials and Methods" for supports, anchors, and identification products.
 - 2. Section "Wiring Devices" for devices installed in boxes.
 - 3. Section "Seismic Controls for Electrical Work" for seismic restraints and bracing of raceways, boxes, enclosures, and cabinets.

1.3 DEFINITIONS

- A. EMT: Electrical metallic tubing.
- B. FMC: Flexible metal conduit.
- C. LFMC: Liquidtight flexible metal conduit.
- D. RNC: Rigid nonmetallic conduit.

1.4 SUBMITTALS

- A. Product Data: For raceways, fittings, wireways, hinged-cover enclosures, and cabinets.
- B. Shop Drawings: Signed and sealed by a qualified professional engineer.
 - 1. Design Calculations: Calculate requirements for selecting seismic restraints.
 - 2. Detail assemblies and indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.
- C. Manufacturer Seismic Qualification Certification: Submit certification that enclosures, cabinets, accessories, and components will withstand seismic forces defined in Section "Seismic Controls for Electrical Work." Include the following:
 - 1. Basis for Certification: Indicate whether withstand certification is based on actual test of assembled components or on calculation.

- a. The term "withstand" means "the unit will remain in place without separation of any parts from the device when subjected to the seismic forces specified and the unit will be fully operational after the seismic event."
2. Dimensioned Outline Drawings of Equipment Unit: Identify center of gravity and locate and describe mounting and anchorage provisions.
3. Detailed description of equipment anchorage devices on which the certification is based and their installation requirements.

1.5 QUALITY ASSURANCE

- A. 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.
- B. Comply with NFPA 70.

1.6 COORDINATION

- A. Coordinate layout and installation of raceways, boxes, enclosures, cabinets, and suspension system with other construction that penetrates ceilings or is supported by them, including light fixtures, HVAC equipment, fire-suppression system, and partition assemblies.

1.7 FIELD CONDITIONS

- A. Ground Water: Assume ground-water level is at grade level unless a lower water table is noted on Drawings.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, provide products by the manufacturers specified.

2.2 METAL CONDUIT AND TUBING

- A. Manufacturers:
 1. Alflec Inc.
 2. Allied Tube and Conduit.
 3. Anamet Electrical, Inc.; Anaconda Metal Hose.
 4. Atkore International / Calbrite.
 5. Conduit Pipe Products Company.
 6. Electri-Flex Co.
 7. Gibson Stainless.
 8. Grinnell Co./Tyco International; Allied Tube and Conduit Div.
 9. Manhattan/CDT/Cole-Flex.
 10. Maverick Tube.
 11. O-Z Gedney; Unit of General Signal.

12. Patriot Industries.
13. Republic Conduit.
14. Shaw Stainless and Alloy.
15. Wheatland Tube Co.
16. Or approved equal.

- B. Rigid Aluminum Conduit: Produced to ANSI C80.5; listed to UL 6A.
- C. EMT and Fittings: Produced to ANSI C80.3; listed to UL 797.
- D. FMC: Listed to UL 1.
- E. LFMC: Listed to UL 360.
- F. Fittings: NEMA FB 1; compatible with conduit and tubing materials.

2.3 NONMETALLIC CONDUIT AND TUBING

A. Manufacturers:

1. American International.
2. Anamet Electrical, Inc.; Anaconda Metal Hose.
3. Arnco.
4. Blue Diamond Industries.
5. Cantex.
6. Certainteed.
7. Condux International.
8. ElecSYS.
9. Electri-Flex.
10. Heritage Plastics / Atkore International.
11. Lamson & Sessions; Carlon Electrical Products.
12. Manhattan/CDT/Cole-Flex.
13. Queen City Plastics.
14. RACO.
15. Southern Pipe, Inc.
16. Spiraldut, Inc./AFC Cable Systems, Inc.
17. Thomas & Betts.
18. Or approved equal.

- B. RNC: Produced to NEMA TC 2; listed to UL 651.

1. Schedule 40 and Schedule 80 PVC.

- C. RNC Fittings: Produced to NEMA TC 3; listed to UL 514B; match to conduit or tubing type and material.

2.4 BOXES, ENCLOSURES, AND CABINETS

A. Manufacturers:

1. Arlington.
2. Austin.

3. B-Line.
 4. Cooper Crouse-Hinds.
 5. Emerson/General Signal; Appleton Electric Company.
 6. Erickson.
 7. FSR.
 8. Hammond.
 9. Hoffman.
 10. Hubbell.
 11. Milbank.
 12. O-Z/Gedney.
 13. Peerless.
 14. RACO.
 15. Robroy Industries.
 16. Rose + Bopla.
 17. Scott Fetzer Co.; Adalet-PLM Division.
 18. Spring City Electrical.
 19. Strong.
 20. Thomas & Betts.
 21. Vynckier.
 22. Walker Systems.
 23. Woodhead Industries.
 24. Or approved equal.
- B. Sheet Metal Outlet and Device Boxes: NEMA OS 1.
- C. Cast-Metal Outlet and Device Boxes: NEMA FB 1, Type FD, with gasketed cover.
- D. Small Sheet Metal Pull and Junction Boxes: NEMA OS 1.
- E. Cast-Metal Pull and Junction Boxes: NEMA FB 1, cast aluminum with gasketed cover.
- F. Metal Hinged-Cover Enclosures:
1. Interior Locations: NEMA 250, Type 1 with continuous hinged cover, concealed hinge, and flush latch. Finished inside and out with manufacturer's standard enamel.
 2. Exterior Locations: NEMA 250, Type 4X stainless steel with continuous hinged cover and 3-point latch.
 3. Removable interior panel.
 4. Metal barriers to separate wiring of different systems and voltages.
 5. Accessory feet where required or freestanding applications.
- G. HANDHOLES AND BOXES FOR EXTERIOR UNDERGROUND WIRING
1. General Requirements for Handholes and Boxes:
 - a. Boxes and handholes for use in underground systems shall be designed and identified as defined in NFPA 70, for intended location and application.
 - b. Boxes installed in wet areas shall be listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

2. Polymer-Concrete Handholes and Boxes with Polymer-Concrete Cover: Molded of sand and aggregate, bound together with polymer resin, and reinforced with steel, fiberglass, or a combination of the two.
 - a. Manufacturers:
 - 1) Quazite.
 - 2) Or preapproved equal.
 - b. Configuration: Designed for flush burial with open bottom unless otherwise indicated.
 - c. Cover:
 - 1) Weatherproof, secured by tamper-resistant locking devices.
 - 2) Structural load rating consistent with enclosure and handhole location. See drawing details for additional requirements.
 - 3) Nonskid finish.
 - 4) Cover legend text as detailed.
 - d. Conduit Entrance Provisions: Conduit-terminating fittings shall mate with entering ducts for secure, fixed installation in enclosure wall.

2.5 RACEWAY APPLICATION

A. Outdoors:

1. Exposed: Rigid aluminum.
2. Concealed: Rigid aluminum.
3. Underground, Single Run: RNC.
4. Underground, Grouped: RNC.
5. Connection to Vibrating Equipment (Including Transformers and Hydraulic, Pneumatic, Electric Solenoid, or Motor-Driven Equipment): LFMC.
6. For grounding electrode conductors: RNC Schedule 80.
7. Boxes and Enclosures: NEMA 250, Type 4X stainless steel or 4X aluminum.

B. Indoors:

1. Exposed, Higher than 10' AFF: EMT.
2. Exposed, Lower than 10' AFF: Rigid aluminum.
3. Concealed: EMT.
4. Underground branch circuits: RNC.
5. Underground feeders: RNC.
 - a. Concrete encased where outside of a building footprint.
6. Connection to Vibrating Equipment (Including Transformers and Hydraulic, Pneumatic, Electric Solenoid, or Motor-Driven Equipment): FMC; except use LFMC in damp or wet locations.
7. Damp or Wet Locations: Rigid aluminum conduit.
8. For grounding electrode conductors: RNC Schedule 80.
9. Boxes and Enclosures: NEMA 250, Type 1, except as follows:
 - a. Damp or Wet Locations: NEMA 250, Type 4.

C. Minimum Raceway Size: 3/4-inch trade size (DN 21).

- D. Raceway Fittings: Compatible with raceways and suitable for use and location.
- E. Do not install aluminum conduits embedded in or in contact with earth or concrete. For direct burial or concrete encasement or penetrations, coat conduit with asphaltum or bitumastic type coating.
- F. EMT shall not be installed where raceway or fittings would be in direct contact with the earth, underground, in/below concrete, exposed to the elements, exposed to severe physical damage, or exposed to severe corrosive influence.

2.6 INSTALLATION

- A. Keep raceways a minimum of 6 inches away from runs of flues and steam or hot-water pipes. Install horizontal raceway runs above water and steam piping.
- B. Complete raceway installation before starting conductor installation.
- C. Support raceways as specified in Section "Basic Electrical Materials and Methods."
- D. Install temporary closures to prevent foreign matter from entering raceways.
- E. Protect stub-ups from damage where conduits rise through floor slabs. Arrange so curved portions of bends are not visible above the finished slab.
- F. Make bends and offsets so ID is not reduced. Keep legs of bends in the same plane and keep straight legs of offsets parallel, unless otherwise indicated.
- G. Conceal raceways within finished walls, ceilings, and floors, unless otherwise indicated.
 - 1. Install concealed raceways with a minimum of bends in the shortest practical distance, considering type of building construction and obstructions, unless otherwise indicated.
- H. Conduits installed on the inside face of exterior building walls shall be spaced off the wall surface a minimum of 1/4" using strut-type channel or "clamp-backs".
- I. Install exposed raceways parallel or at right angles to nearby surfaces or structural members and follow surface contours as much as possible.
 - 1. Run parallel or banked raceways together on common supports.
 - 2. Make parallel bends in parallel or banked runs. Use factory elbows only where elbows can be installed parallel; otherwise, provide field bends for parallel raceways.
- J. Join raceways with fittings designed and approved for that purpose and make joints tight.
- K. Raceway connectors shall be insulated throat type. If uninsulated throat connectors are installed, use insulating bushings to protect conductors.

- L. Raceways Embedded in Slabs: Install in middle 1/3 of slab thickness where practical and leave at least 2 inches (50 mm) of concrete cover.
 - 1. Secure raceways to reinforcing rods to prevent sagging or shifting during concrete placement.
 - 2. Space raceways laterally to prevent voids in concrete.
 - 3. Run conduit larger than 1-inch trade size (DN 27) parallel or at right angles to main reinforcement. Where at right angles to reinforcement, place conduit close to slab support.
 - 4. Where turning up into cabinets, equipment, poles, etc.; transition from PVC to rigid steel elbows & raceway stub-ups.
- M. Underground raceways:
 - 1. Where turning up to cabinets, equipment, poles, etc.; transition from horizontal underground PVC to rigid aluminum for elbows & raceway stub-ups. Coat rigid aluminum as specified where in contact with earth or concrete.
 - 2. Feeder raceways run external to building foundation walls, shall be encased with a minimum of three (3") inches of concrete on all sides.
 - 3. Encased raceways containing circuits with voltages 600 Volts and less shall have a minimum cover of eighteen (18") inches.
- N. Terminations:
 - 1. Where raceways are terminated with locknuts and bushings, align raceways to enter squarely and install locknuts with dished part against box. Use two locknuts, one inside and one outside box.
 - 2. Where raceways are terminated with threaded hubs, screw raceways or fittings tightly into hub so end bears against wire protection shoulder. Where chase nipples are used, align raceways so coupling is square to box; tighten chase nipple so no threads are exposed.
 - 3. Where using boxes with concentric, eccentric, or over-sized knockouts; provide bonding bushings and jumpers. Size bonding jumpers in accordance with NEC Table 250-122, connecting to the box with ground lugs.
- O. Install pull wires in empty raceways. Use polypropylene or monofilament plastic line with not less than 200-lb tensile strength. Leave at least 12 inches of slack at each end of pull wire. Label each end of pull wires with location of opposite end.
- P. Telephone and Signal System Raceways, 2-Inch Trade Size and Smaller: In addition to above requirements, install raceways in maximum lengths of 150 feet and with a maximum of two 90-degree bends or equivalent. Separate lengths with pull or junction boxes where necessary to comply with these requirements.
- Q. Flexible Connections:
 - 1. Use maximum of 72 inches of flexible conduit for recessed and semi-recessed lighting fixtures.
 - 2. Use maximum of 24 inches of flexible conduit for equipment subject to vibration, noise transmission, or movement; and for all motors.
 - 3. Use LFMC in damp or wet locations.

- R. Install hinged-cover enclosures and cabinets plumb. Support at each corner.

2.7 PROTECTION

- A. Provide final protection and maintain conditions that ensure coatings, finishes, and cabinets are without damage or deterioration at time of Final Acceptance.
 - 1. Repair damage to galvanized finishes with zinc-rich paint recommended by manufacturer.
 - 2. Repair damage to PVC or paint finishes with matching touchup coating recommended by manufacturer.

2.8 CLEANING

- A. After completing installation of exposed, factory-finished raceways and boxes, inspect exposed finishes and repair damaged finishes.

END OF SECTION 260533

SECTION 260548 - SEISMIC CONTROLS FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section Includes:
 - 1. Restraint channel bracings.
 - 2. Restraint cables.
 - 3. Seismic-restraint accessories.
 - 4. Mechanical anchor bolts.
 - 5. Adhesive anchor bolts.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product.
 - 1. Illustrate and indicate style, material, strength, fastening provision, and finish for each type and size of seismic-restraint component used.
 - a. Tabulate types and sizes of seismic restraints, complete with report numbers and rated strength in tension and shear as evaluated by an agency acceptable to authorities having jurisdiction.
 - b. Annotate to indicate application of each product submitted and compliance with requirements.
- B. Delegated-Design Submittal: For each seismic-restraint device.
 - 1. Include design calculations and details for selecting seismic restraints complying with performance requirements, design criteria, and analysis data signed and sealed by the qualified professional engineer responsible for their preparation.
 - 2. Design Calculations: Calculate static and dynamic loading caused by equipment weight, operation, and seismic and wind forces required to select seismic and wind restraints and for designing vibration isolation bases.
 - a. Coordinate design calculations with wind load calculations required for equipment mounted outdoors. Comply with requirements in other Sections for equipment mounted outdoors.
 - 3. Seismic- and Wind-Restraint Details:
 - a. Design Analysis: To support selection and arrangement of seismic and wind restraints. Include calculations of combined tensile and shear loads.
 - b. Details: Indicate fabrication and arrangement. Detail attachments of restraints to the restrained items and to the structure. Show attachment locations, methods, and spacings. Identify components, list their strengths,

- and indicate directions and values of forces transmitted to the structure during seismic events. Indicate association with vibration isolation devices.
- c. Coordinate seismic-restraint and vibration isolation details with wind-restraint details required for equipment mounted outdoors. Comply with requirements in other Sections for equipment mounted outdoors.
- d. Preapproval and Evaluation Documentation: By an agency acceptable to authorities having jurisdiction, showing maximum ratings of restraint items and the basis for approval (tests or calculations).

- C. Product Certificates: Signed by manufacturers of seismic restraints certifying that products furnished comply with requirements, including the testing requirements of the 2012 North Carolina Building Code, Section 1708.4.

1.4 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For professional engineer.
- B. Field quality-control reports.

1.5 QUALITY ASSURANCE

- A. Comply with seismic restraint requirements in 2012 North Carolina Building Code, Section 1613, unless requirements in this Section are more stringent.
- B. Professional Engineer Qualifications: A professional engineer who is legally qualified to practice in jurisdiction where Project is located and who is experienced in providing seismic engineering services, including the design of seismic restraints, that are similar to those indicated for this Project.
- C. Seismic-restraint devices shall have horizontal and vertical load testing and analysis. They shall bear anchorage preapproval from OSHPD in addition to preapproval, showing maximum seismic-restraint ratings, by ICC-ES or another agency acceptable to authorities having jurisdiction. Ratings based on independent testing are preferred to ratings based on calculations. If preapproved ratings are not available, submittals based on independent testing are preferred. Calculations (including combining shear and tensile loads) that support seismic-restraint designs must be signed and sealed by a qualified professional engineer.
- D. Comply with NFPA 70.

1.6 PROJECT CONDITIONS

- A. Seismic Design Category: See the project Code Summary drawing and structural drawings.
- B. See the project Code Summary drawing and structural drawings for additional building construction criteria.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Wind-Restraint Loading:

1. Basic Wind Speed: Obtain value from the wind map, in the North Carolina Building Code.
2. Building Classification Category: See the project Code Summary drawing and structural drawings.
3. Minimum 10 lb/sq. ft. (48.8 kg/sq. m) multiplied by maximum area of equipment component projected on vertical plane normal to wind direction and 45 degrees either side of normal.

B. Seismic-Restraint Loading:

1. Seismic Design Category: See the project Code Summary drawing and structural drawings.

2.2 RESTRAINT CHANNEL BRACINGS

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. Cooper B-Line, Inc.; a Division of Cooper Industries.
2. Hilti, Inc.
3. Mason Industries, Inc.
4. Unistrut; Atkore International.

B. Description: MFMA-4, shop- or field-fabricated bracing assembly made of slotted steel channels with accessories for attachment to braced component at one end and to building structure at the other end, with other matching components, and with corrosion-resistant coating; rated in tension, compression, and torsion forces.

2.3 RESTRAINT CABLES

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. Kinetics Noise Control, Inc.
2. Loos & Co., Inc.
3. Vibration Mountings & Controls, Inc.

B. Restraint Cables: ASTM A 492 stainless-steel cables. End connections made of steel assemblies with thimbles, brackets, swivel, and bolts designed for restraining cable service; with a minimum of two clamping bolts for cable engagement.

2.4 SEISMIC-RESTRAINT ACCESSORIES

- 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. Cooper B-Line, Inc.; a Division of Cooper Industries.
 2. Kinetics Noise Control, Inc.
 3. Mason Industries, Inc.
 4. TOLCO; a brand of NIBCO INC.
- B. Hanger-Rod Stiffener: Steel tube or steel slotted-support-system sleeve with internally bolted connections or reinforcing steel angle clamped to hanger rod.
- C. Hinged and Swivel Brace Attachments: Multifunctional steel connectors for attaching hangers to rigid channel bracings and restraint cables.
- D. Bushings for Floor-Mounted Equipment Anchor Bolts: Neoprene bushings designed for rigid equipment mountings and matched to type and size of anchor bolts and studs.
- E. Bushing Assemblies for Wall-Mounted Equipment Anchorage: Assemblies of neoprene elements and steel sleeves designed for rigid equipment mountings and matched to type and size of attachment devices used.
- F. Resilient Isolation Washers and Bushings: One-piece, molded, oil- and water-resistant neoprene, with a flat washer face.

2.5 MECHANICAL ANCHOR BOLTS

- 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. Cooper B-Line, Inc.; a Division of Cooper Industries.
 2. Hilti, Inc.
 3. Kinetics Noise Control, Inc.
 4. Mason Industries, Inc.
- B. Mechanical Anchor Bolts: Drilled-in and stud-wedge or female-wedge type in zinc-coated steel for interior applications and stainless steel for exterior applications. Select anchor bolts with strength required for anchor and as tested according to ASTM E 488. Note: Expansion-type anchor bolts are not permitted by ASCE/SEI 7 for nonisolated equipment in excess of 10 hp (7.46 kW).

2.6 ADHESIVE ANCHOR BOLTS

- 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. Hilti, Inc.
 2. Kinetics Noise Control, Inc.

3. Mason Industries, Inc.

- B. Adhesive Anchor Bolts: Drilled-in and capsule anchor system containing PVC or urethane methacrylate-based resin and accelerator, or injected polymer or hybrid mortar adhesive. Provide anchor bolts and hardware with zinc-coated steel for interior applications and stainless steel for exterior applications. Select anchor bolts with strength required for anchor and as tested according to ASTM E 488.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine areas and equipment to receive vibration isolation and seismic-control devices for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.
- B. Examine roughing-in for reinforcement and cast-in-place anchors to verify actual locations before installation.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 COORDINATION

- A. Coordinate layout and installation of seismic bracing with building structural system and architectural features, and with mechanical, fire-protection, electrical, and other building features in the vicinity.
- B. Coordinate concrete bases with building structural system.

3.3 APPLICATIONS

- A. Multiple Raceways or Cables: Secure raceways and cables to trapeze member with clamps approved for application by an agency acceptable to authorities having jurisdiction.
- B. Hanger-Rod Stiffeners: Install hanger-rod stiffeners where required to prevent buckling of hanger rods caused by seismic forces.
- C. Strength of Support and Seismic-Restraint Assemblies: Select sizes of components so strength will be adequate to carry present and future static and seismic loads within specified loading limits.

3.4 SEISMIC-RESTRAINT DEVICE INSTALLATION

- A. Coordinate the location of embedded connection hardware with supported equipment attachment and mounting points and with requirements for concrete reinforcement and formwork."
- B. Equipment and Hanger Restraints:

1. Install resilient, bolt-isolation washers on equipment anchor bolts where clearance between anchor and adjacent surface exceeds 0.125 inch (3.2 mm).
 2. Install seismic-restraint devices using methods approved by an agency acceptable to authorities having jurisdiction providing required submittals for component.
- C. Install cables so they do not bend across edges of adjacent equipment or building structure.
- D. Install bushing assemblies for mounting bolts for wall-mounted equipment, arranged to provide resilient media where equipment or equipment-mounting channels are attached to wall.
- E. Attachment to Structure: If specific attachment is not indicated, anchor bracing to structure at flanges of beams, at upper truss chords of bar joists, or at concrete members.
- F. Drilled-in Anchors:
1. Identify position of reinforcing steel and other embedded items prior to drilling holes for anchors. Do not damage existing reinforcing or embedded items during coring or drilling. Notify the structural engineer if reinforcing steel or other embedded items are encountered during drilling. Locate and avoid prestressed tendons, electrical and telecommunications conduit, and gas lines.
 2. Do not drill holes in concrete or masonry until concrete, mortar, or grout has achieved full design strength.
 3. Wedge Anchors: Protect threads from damage during anchor installation. Heavy-duty sleeve anchors shall be installed with sleeve fully engaged in the structural element to which anchor is to be fastened.
 4. Adhesive Anchors: Clean holes to remove loose material and drilling dust prior to installation of adhesive. Place adhesive in holes proceeding from the bottom of the hole and progressing toward the surface in such a manner as to avoid introduction of air pockets in the adhesive.
 5. Set anchors to manufacturer's recommended torque using a torque wrench.
 6. Install zinc-coated steel anchors for interior and stainless-steel anchors for exterior applications.

3.5 ACCOMMODATION OF DIFFERENTIAL SEISMIC MOTION

- A. Install flexible connections in runs of raceways, cables, wireways, cable trays, and busways where they cross seismic joints, where adjacent sections or branches are supported by different structural elements, and where connection is terminated to equipment that is anchored to a different structural element from the one supporting them as they approach equipment.

3.6 FIELD QUALITY CONTROL

- A. The Professional Engineer retained for seismic restraint calculations shall visit the job site as necessary to comply with the Special Inspections requirement of the North Carolina Building Code, Section 1707. This engineer shall provide in writing verification of compliance of the installation with the approved seismic submittal. This verification

shall be submitted as a Special Inspections Report and shall bear the Engineer's professional seal. Job site inspections by other than this engineer are not acceptable.

- B. Perform the following tests and inspections with the assistance of a factory-authorized service representative (if required):
 - 1. Provide evidence of recent calibration of test equipment by a testing agency acceptable to authorities having jurisdiction.
 - 2. Schedule test with Owner, through Architect / Engineer, before connecting anchorage device to restrained component (unless post-connection testing has been approved), and with at least seven days' advance notice.
 - 3. Obtain Architect / Engineer's approval before transmitting test loads to structure. Provide temporary load-spreading members.
 - 4. Test at least four of each type and size of installed anchors and fasteners selected by Architect / Engineer.
 - 5. Test to 90 percent of rated proof load of device.
- C. Seismic controls will be considered defective if they do not pass tests and inspections.
- D. Prepare test and inspection reports.

3.7 ADJUSTING

- A. Adjust restraints to permit free movement of equipment within normal mode of operation.

END OF SECTION 260548

SECTION 260553 - ELECTRICAL IDENTIFICATION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. This Section includes electrical identification materials and devices intended to comply with NFPA 70, OSHA standards, and authorities having jurisdiction.

1.3 SUBMITTALS

- A. Product Data:
 - 1. For each electrical identification product indicated.
 - 2. For double coated, adhesive tape product indicated.

1.4 QUALITY ASSURANCE

- A. Comply with NFPA 70.
- B. Comply with NFPA 70 for color-coding.

PART 2 - PRODUCTS

2.1 CABLE LABELS

- A. Colored Adhesive Tape: Self-adhesive vinyl tape not less than 3 mils thick by 1 to 2 inches.
- B. Underground-Line Warning Tape: Permanent, bright-colored, continuous-printed, vinyl tape.
 - 1. Not less than 6 inches wide by 4 mils thick.
 - 2. Compounded for permanent direct-burial service.
 - 3. Embedded continuous metallic strip or core.
 - 4. Printed legend indicating type of underground line.

2.2 NAMEPLATES AND SIGNS

- A. Engraved Plastic Nameplates and Signs: Engraving stock, plastic laminate, minimum 1/16" thick for signs up to 20 sq. in. and 1/8" thick for larger sizes.
- B. Fasteners for Nameplates and Signs:
 - 1. High performance, double coated tape with adhesive. Design Basis: 3M #06383, or approved equivalent.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Identification Materials and Devices: Install at locations for most convenient viewing without interference with operation and maintenance of equipment.
- B. Lettering, Colors, and Graphics: Coordinate names, abbreviations, colors, and other designations with corresponding designations in the Contract Documents or with those required by codes and standards. Use consistent designations throughout Project.
- C. Sequence of Work: If identification is applied to surfaces that require finish, install identification after completing finish work.
- D. Self-Adhesive Identification Products: Clean surfaces before applying.
- E. Circuit Identification Labels on Boxes: Panel and circuit number.
 - 1. Interior Boxes:
 - a. Exposed: Pressure-sensitive, self-adhesive plastic label on cover.
 - b. Concealed:
 - 1) Pressure-sensitive, self-adhesive plastic label on cover; or
 - 2) Permanent marker on cover, legible by Architect, Engineer, and Owner.
 - 2. Exterior Boxes:
 - a. Engraved plastic label on cover; and
 - b. Pressure-sensitive, self-adhesive plastic label inside cover.
- F. Paths of Underground Electrical Lines: During trench backfilling, for exterior underground power, control, signal, and communication lines, install continuous underground-line warning tape located directly above line at 6 to 8 inches below finished grade. Where width of multiple lines installed in a common trench or concrete envelope does not exceed 16 inches overall, use a single line marker. Install line marker for underground wiring, both direct-buried cables and cables in raceway.
- G. Color-Coding of Phase, Neutral, and Ground Conductors: Use the following colors for service, feeder, and branch-circuit phase conductors:

	<u>Configuration</u>	<u>Phase A</u>	<u>Phase B</u>	<u>Phase C</u>	<u>Neutral</u>	<u>Ground</u>
1.	120/208-V, 3 Ph, 4W	Black	Red	Blue	White	Green
2.	For conductors #6 AWG and smaller, factory apply color the entire length of conductors.					
3.	For conductors #4 AWG and larger, field apply colored, pressure-sensitive plastic tape in half-lapped turns for a distance of 6 inches from terminal points and in boxes where splices or taps are made. Apply last two turns of tape with no tension to prevent possible unwinding. Use 1-inch- wide tape in colors specified. Adjust tape bands to avoid obscuring cable identification markings.					
4.	At each panelboard, a color code legend shall be permanently posted corresponding to the conductors and voltage in that panelboard.					

- H. Apply identification to conductors as follows:
1. Conductors to Be Extended in the Future: Indicate source and circuit numbers.
 2. Multiple Power or Lighting Circuits in the Same Enclosure: Identify each conductor with source, voltage, circuit number, and phase. Use color-coding to identify circuits' voltage and phase.
 3. Multiple Control and Communication Circuits in the Same Enclosure: Identify each conductor by its system and circuit designation. Use a consistent system of tags, color-coding, or cable marking tape.
- I. Equipment Identification Labels: Engraved plastic laminate. Install on each unit of equipment unless units are delivered with their own self-explanatory identification. Attached engraved labels with high performance double coated adhesive tape. Apply labels for each unit of the following categories of equipment:
1. Panelboards, electrical cabinets, and enclosures.
 2. Access doors and panels for concealed electrical items.
 3. Disconnect switches and enclosed circuit breakers.
 4. Inverters.
 5. Fire alarm control panels, master stations, control panels, local operator consoles, and power supplies.
- J. Nameplate colors shall be: White surface with black core.

END OF SECTION 260553

SECTION 260923 - LIGHTING CONTROL DEVICES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. This Section includes the following lighting control devices:
 - 1. Time switches.
 - 2. Outdoor photoelectric switches
 - 3. Switchbox-mounted occupancy and vacancy sensors.
 - 4. Indoor occupancy and vacancy sensors.
 - 5. Multipole contactors.

- B. PIR: Passive infrared.

1.3 SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Operation and Maintenance Data: For each type of product to include in emergency, operation, and maintenance manuals.

1.4 QUALITY ASSURANCE

- A. Electrical Components, Devices, and Accessories: Listed and labeled by a third party agency that is accredited by the NCBCC (North Carolina Building Code Council) to label electrical & mechanical equipment.

1.5 COORDINATION

- A. Coordinate layout and installation of ceiling-mounted devices with other construction that penetrates ceilings or is supported by them, including light fixtures, HVAC equipment, fire-suppression system, and partition assemblies.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the manufacturers specified.

2.2 GENERAL LIGHTING CONTROL DEVICE REQUIREMENTS

- A. Line-Voltage Surge Protection: An integral part of the devices for 120- and 277-V solid-state equipment. For devices without integral line-voltage surge protection, field-mounting surge protection shall comply with IEEE C62.41 and with UL 1449.

2.3 TIME SWITCHES

- A. Manufacturers:
1. Area Lighting Research, Inc.
 2. Fisher Pierce.
 3. Grasslin Controls Corporation.
 4. Intermatic, Inc.
 5. Paragon Electric Co.
 6. TORK.
 7. Watt Stopper (The).
- B. Digital Time Switches: Electronic, solid-state programmable units with alphanumeric display complying with UL 917.
1. Contact Configuration: DPST.
 2. Contact Rating: 30-A inductive or resistive, 240-V ac.
 3. Program: Single channel, 8 on-off set points on a 24-hour schedule and an annual holiday schedule that overrides the weekly operation on holidays.
 4. Circuitry: Allow connection of a photoelectric relay as substitute for on and off function of a program.
 5. Astronomical Time: All channels.
 6. Battery Backup: For schedules and time clock.

2.4 OUTDOOR PHOTOELECTRIC SWITCHES

- A. Manufacturers:
1. Area Lighting Research, Inc.
 2. Fisher Pierce.
 3. Grasslin Controls Corporation.
 4. Intermatic, Inc.
 5. Paragon Electric Co.
 6. TORK.
 7. Touchplate Technologies, Inc.
 8. Watt Stopper (The).
- B. Description: Solid state, with DPST dry contacts rated for 1800-VA tungsten or 1000-VA inductive, to operate connected relay, contactor coils, microprocessor input, and complying with UL 773A.
1. Light-Level Monitoring Range: 1.5 to 10 fc (16 to 108 lx), with an adjustment for turn-on and turn-off levels within that range, and a directional lens in front of photocell to prevent fixed light sources from causing turn-off.
 2. Time Delay: 15-second minimum, to prevent false operation.

3. Surge Protection: Metal-oxide varistor type, complying with IEEE C62.41 for Category A1 locations.
4. Mounting: Twist lock complying with IEEE C136.10, with base-and-stem mounting or stem-and-swivel mounting accessories as required to direct sensor to the North sky exposure.

2.5 SWITCHBOX-MOUNTED OCCUPANCY AND VACANCY SENSORS

A. Manufacturers:

1. Cooper Controls.
2. Hubbell Lighting Inc.
3. Leviton Mfg. Company Inc.
4. Watt Stopper (The).

B. Description: Dual technology, ultrasonic and PIR type, with integral power-switching contacts rated for 800 W at 120-V ac and 1200 W at 277-V ac, minimum; suitable for electronic ballasts, LED drivers, or 1/6-hp motors.

1. Configurable occupancy sensing or vacancy sensing operating modes.
Operation:
 - a. Occupancy Sensor: Unless otherwise indicated, turn lights on when coverage area is occupied, and turn them off when unoccupied; with a time delay for turning lights off, adjustable over a minimum range of 1 to 15 minutes.
 - b. Vacancy Sensor: Unless otherwise indicated, lights are manually turned on and sensor turns lights off when the room is unoccupied; with a time delay for turning lights off, adjustable over a minimum range of 1 to 15 minutes.
2. Include ground wire.

C. Single Relay Unit: Device contains one relay for controlling load circuit.

1. Design Basis: Hubbell # LHMTS1.
2. One On-Off button for manual control.

D. Dual Relay Unit: Device contains two relays for controlling independent lighting loads or circuits.

1. Design Basis: Hubbell #LHMTD2.
2. Two On-Off buttons for manual control.

E. Dimmer Unit:

1. Design Basis: Legrand / WattStopper #DW-311.
2. Dimming Control Signal: 0-10 VDC.
3. Suitable for multi-way control from up to four locations.

2.6 INDOOR OCCUPANCY AND VACANCY SENSORS

A. Manufacturers:

1. Cooper Controls.
2. Hubbell Lighting Inc.

3. Leviton Mfg. Company Inc.
 4. Watt Stopper (The).
- B. General Description: Wall- or ceiling-mounting, as indicated on the drawings; solid-state units with a separate relay unit.
1. Configurable occupancy sensing or vacancy sensing operating modes.
Operation:
 - a. Occupancy Sensor: Unless otherwise indicated, turn lights on when coverage area is occupied, and turn them off when unoccupied; with a time delay for turning lights off, adjustable over a minimum range of 1 to 15 minutes.
 - b. Vacancy Sensor: Unless otherwise indicated, lights are manually turned on and sensor turns lights off when the room is unoccupied; with a time delay for turning lights off, adjustable over a minimum range of 1 to 15 minutes.
 2. Sensor Output: Contacts rated to operate the connected relay, complying with UL 773A. Sensor shall be powered from the relay unit.
 3. Relay Units: Dry contacts rated for 20-A ballast load at 120- and 277-V ac, for 13-A tungsten at 120-V ac, and for 1 hp at 120-V ac. Power supply to sensor shall be 24-V dc, 150-mA, Class 2 power source as defined by NFPA 70.
 - a. Where indicated for 277-V ac lighting systems, provide additional relay units where required for simultaneous control of 120-V ac exhaust fans.
 4. Mounting:
 - a. Sensor: Suitable for mounting in any position on a standard outlet box.
 - b. Relay: Externally mounted through a 1/2-inch (13-mm) knockout in a standard electrical enclosure.
 - c. Time-Delay and Sensitivity Adjustments: Recessed and concealed behind hinged door.
 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. Automatic Light-Level Sensor: Adjustable from 2 to 200 fc (215 to 2150 lx); keeps lighting off when selected lighting level is present.
- C. Dual-Technology Type: Ceiling mounting; 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. Sensitivity Adjustment: Separate for each sensing technology.
 2. Detector Sensitivity: Detect occurrences of 6-inch (150-mm) minimum movement of any portion of a human body that presents a target of at least 36 sq. in. (232 sq. cm), and detect a person of average size and weight moving at least 12 inches (305 mm) in either a horizontal or a vertical manner at an approximate speed of 12 inches/s (305 mm/s).
 3. Detection Coverage (Standard Room): Detect occupancy anywhere within a circular area of 2000 sq. ft. when mounted on a 96-inch- (2440-mm-) high ceiling.

- D. Design Basis: Hubbell # OMNIDT2000. If room size is significantly smaller than 2000 sq. ft., evaluate the use of a unit with applicably sized reduced range.

2.7 MULTIPOLE CONTACTORS

- A. Manufacturers:
 - 1. Allen-Bradley/Rockwell Automation.
 - 2. Cutler-Hammer; Eaton Corporation.
 - 3. GE Industrial Systems.
 - 4. Siemens.
 - 5. Square D.
- B. Description: Electrically operated and mechanically held, complying with NEMA ICS 2 and UL 508.
 - 1. Current Rating for Switching: Listing or rating consistent with type of load served, including tungsten filament, inductive, and high-inrush ballast (ballast with 15 percent or less total harmonic distortion of normal load current).
 - 2. Control-Coil Voltage: Match control power source.

PART 3 - EXECUTION

3.1 SENSOR INSTALLATION

- A. Install and aim sensors in locations to achieve at least 90 percent coverage of areas indicated. Do not exceed coverage limits specified in manufacturer's written instructions.

3.2 WIRING INSTALLATION

- A. Wiring Method: Comply with Section "Conductors and Cables."
- B. Wiring within Enclosures: Bundle, lace, and train conductors to terminal points. Separate power-limited and nonpower-limited conductors according to conductor manufacturer's written instructions.
- C. Size conductors according to lighting control device manufacturer's written instructions, unless otherwise indicated.
- D. Splices, Taps, and Terminations: Make connections only on numbered terminal strips in junction, pull, and outlet boxes; terminal cabinets; and equipment enclosures.
- E. Tighten electrical connectors and terminals according to manufacturer's published torque-tightening values. If manufacturer's torque values are not indicated, use those specified in UL 486A and UL 486B.

3.3 IDENTIFICATION

- A. Identify components and power and control wiring according to Section "Electrical Identification."

- B. Label time switches and contactors with a unique designation.

3.4 FIELD QUALITY CONTROL

- A. Perform the following field tests and inspections and prepare test reports:
 - 1. After installing time switches and sensors, and after electrical circuitry has been energized, adjust and test for compliance with requirements.
 - 2. Operational Test: Verify actuation of each sensor and adjust time delays.
- B. Remove and replace lighting control devices where test results indicate that they do not comply with specified requirements.
- C. Additional testing and inspecting, at Contractor's expense, will be performed to determine compliance of replaced or additional work with specified requirements.

3.5 ADJUSTING

- A. Occupancy Adjustments: When requested within 6 months from date of Final Completion, provide on-site assistance in adjusting lighting control devices to suit actual occupied conditions. Provide up to two visits to Project during other-than-normal occupancy hours for this purpose.
 - 1. For occupancy and motion sensors, verify operation at outer limits of detector range. Set time delay to suit Owner's operations.

END OF SECTION 260923

SECTION 262416 - PANELBOARDS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. This Section includes the following:
 - 1. Lighting and appliance branch-circuit panelboards.

1.3 DEFINITIONS

- A. GFCI: Ground-fault circuit interrupter.
- B. RMS: Root mean square.

1.4 SUBMITTALS

- A. Product Data: For each type of panelboard, overcurrent protective device, accessory, and component indicated. Include dimensions and manufacturers' technical data on features, performance, electrical characteristics, ratings, and finishes.
- B. Shop Drawings: For each panelboard and related equipment.
 - 1. Dimensioned plans, elevations, sections, and details. Show tabulations of installed devices, equipment features, and ratings. Include the following:
 - a. Enclosure types and details for types other than NEMA 250, Type 1.
 - b. Trim types and details.
 - c. Bus configuration, current, and voltage ratings.
 - d. Short-circuit current rating of panelboards and overcurrent protective devices.
 - e. Features, characteristics, ratings, and factory settings of individual overcurrent protective devices and auxiliary components.
- C. Manufacturer Seismic Qualification Certification: Submit certification that panelboards, overcurrent protective devices, accessories, and components will withstand seismic forces defined in Section "Seismic Controls for Electrical Work." Include the following:
 - 1. Basis of Certification: Indicate whether withstand certification is based on actual test of assembled components or on calculation.
 - a. The term "withstand" means "the unit will remain in place without separation of any parts from the device when subjected to the seismic forces specified and the unit will be fully operational after the seismic event."

2. Dimensioned Outline Drawings of Equipment Unit: Identify center of gravity and locate and describe mounting and anchorage provisions.
 3. Detailed description of equipment anchorage devices on which the certification is based and their installation requirements.
- D. Panelboard Schedules: For installation in panelboards.
- E. Operation and Maintenance Data: For panelboards and components to include in emergency, operation, and maintenance manuals. If Section "Operation and Maintenance Data" is included in the project manual, in addition to items there, include the following:
1. Manufacturer's written instructions for testing and adjusting overcurrent protective devices.
 2. Time-current curves, including selectable ranges for each type of overcurrent protective device.
 3. Circuit breaker trip settings.

1.5 QUALITY ASSURANCE

- A. Source Limitations: Obtain panelboards, overcurrent protective devices, components, and accessories through one source from a single manufacturer.
- B. Product Options: Drawings indicate size, profiles, and dimensional requirements of panelboards and are typically based on Square D products. Products of other manufacturers are acceptable if they can be installed in the space indicated.
- 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 NEMA PB 1.
- E. Comply with NFPA 70.

1.6 COORDINATION

- A. Coordinate layout and installation of panelboards and components with other construction that penetrates walls or is supported by them, including electrical and other types of equipment, raceways, piping, and encumbrances to workspace clearance requirements.

1.7 EXTRA MATERIALS

- A. Furnish extra materials described below that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
1. Keys: Six spares for each type of panelboard cabinet lock.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. Panelboards, Overcurrent Protective Devices, and Accessories:
 - a. Eaton Corporation; Cutler-Hammer Products.
 - b. General Electric Co.; Electrical Distribution & Protection Div.
 - c. Siemens Energy & Automation, Inc.
 - d. Square D.

2.2 MANUFACTURED UNITS

- A. Enclosures: Flush- and surface-mounted cabinets, as scheduled in the drawings. NEMA PB 1, Type 1.
 - 1. Rated for environmental conditions at installed location.
 - a. Outdoor Locations: NEMA 250, Type 4X stainless steel.
 - 2. Indoor Panelboards, Front Hinged Trim: Entire front trim hinged to box with full-length piano hinge, and with standard door within hinged trim cover.
 - 3. Finish: Manufacturer's standard enamel finish over corrosion-resistant treatment or primer coat.
 - 4. Directory Card: With transparent protective cover, mounted in metal frame, inside panelboard door.
- B. Phase Buses:
 - 1. Material: Hard-drawn copper, 98 percent conductivity.
- C. Ground and Neutral Bars:
 - 1. Equipment Ground Bar: Adequate for feeder and branch-circuit equipment ground conductors; bonded to box.
 - 2. Neutral Bar: Adequate for feeder and branch-circuit neutral conductors.
 - 3. Isolated Equipment Ground Bar: Adequate for branch-circuit isolated equipment ground conductors; insulated from box.
- D. Conductor Connectors: Suitable for use with conductor material.
 - 1. Main and Neutral Lugs: Mechanical type.
 - 2. Ground Lugs and Bus Configured Terminators: Mechanical or compression type.
- E. Service Equipment Label: UL labeled for use as service equipment for panelboards with main service disconnect switches.
- F. Future Devices: Mounting brackets, bus connections, and necessary appurtenances required for future installation of devices. These locations will be indicated as SPACE on the panel schedules in the drawings.

- G. Fabricate and test panelboards to withstand seismic forces defined in Section "Seismic Controls for Electrical Work."

2.3 PANELBOARD SHORT-CIRCUIT RATING

- A. Fully rated to interrupt symmetrical short-circuit current available at terminals.

2.4 LIGHTING AND APPLIANCE BRANCH-CIRCUIT PANELBOARDS

- A. Doors: Concealed hinges; secured with flush latch with tumbler lock; keyed alike.
- B. Main Overcurrent Protective Devices: Circuit breaker, where scheduled.
- C. Branch Overcurrent Protective Devices: Bolt-on circuit breakers, replaceable without disturbing adjacent units.

2.5 OVERCURRENT PROTECTIVE DEVICES

- A. Molded-Case Circuit Breaker: UL 489, with interrupting capacity to meet available fault currents.
 - 1. Thermal-Magnetic Circuit Breakers: Inverse time-current element for low-level overloads, and instantaneous magnetic trip element for short circuits. Adjustable magnetic trip setting for circuit-breaker frame sizes 250 A and larger.
 - 2. GFCI Circuit Breakers: Single- and two-pole configurations
 - a. 5-mA trip sensitivity for personnel protection.
 - b. 30-mA trip sensitivity for equipment protection.
- B. Molded-Case Circuit-Breaker Features and Accessories: Standard frame sizes, trip ratings, and number of poles.
 - 1. Lugs: Mechanical style, suitable for number, size, trip ratings, and conductor materials.
 - 2. Multipole units enclosed in a single housing or factory-assembled to operate as a single unit.
 - 3. Application Listing: Appropriate for application; Type SWD for switching fluorescent lighting loads; Type HACR for heating, air-conditioning, and refrigerating equipment.
 - 4. Ground-Fault Protection: Integrally mounted relay and trip unit with adjustable pickup and time-delay settings, push-to-test feature, and ground-fault indicator.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Install panelboards and accessories according to NEMA PB 1.1.
- B. Mount top of trim 74 inches above finished floor, unless otherwise indicated.
- C. Mount plumb and rigid without distortion of box. Mount recessed panelboards with fronts uniformly flush with wall finish.

- D. Install overcurrent protective devices and controllers. Set field-adjustable circuit-breaker trip ranges.
- E. Panel breaker configurations shall be installed as indicated on the panel schedules or as noted. Breaker position revisions will not be accepted unless approved in writing by the Engineer.
- F. Arrange conductors in gutters into groups and bundle and wrap with wire ties.
- G. Install filler plates in unused spaces.
- H. For flush mounted panelboards and unless noted otherwise, stub four 1-inch empty conduits from panelboard into accessible ceiling space or space designated to be ceiling space in the future.
- I. Install overcurrent protective devices and instrumentation.
 - 1. Set field-adjustable switches and circuit-breaker trip ranges.
 - 2. Prepare documentation of circuit breaker trip settings for Owner record documents.
- J. Comply with mounting and anchoring requirements specified in Section "Seismic Controls for Electrical Work."

3.2 IDENTIFICATION

- A. Identify field-installed conductors, interconnecting wiring, and components; provide warning signs as specified in Section "Electrical Identification".
- B. Create a directory to indicate installed circuit loads. Use a computer or typewriter to create directory; handwritten directories are not acceptable.
- C. Panelboard Nameplates: Label each panelboard with laminated-plastic nameplate mounted as specified in Section "Electrical Identification".

3.3 CONNECTIONS

- A. Ground equipment according to Section "Grounding and Bonding."
- B. Connect wiring according to Section "Conductors and Cables."

3.4 FIELD QUALITY CONTROL

- A. Prepare for acceptance tests as follows:
 - 1. Test insulation resistance for each panelboard bus, component, connecting supply, feeder, and control circuit.
 - 2. Test continuity of each circuit. .
 - 3. Neutral-ground bond testing: After all fixtures, devices and equipment are installed and all connections completed to each panel, the CONTRACTOR shall disconnect the neutral feeder conductor from the neutral bar and take a megger reading between the neutral bar and grounded enclosure. If this reading is less

than 25 mega-ohms, the CONTRACTOR shall disconnect the branch circuit neutral wires from the neutral bar. The CONTRACTOR shall then test each one separately to the panel until the low reading ones are found. The CONTRACTOR shall correct troubles, re-connect, and re-test until at least 25 mega-ohms from the neutral bar to the grounded panel can be achieved with only the neutral feeder disconnected.

B. Perform the following field tests and inspections and prepare test reports:

1. Perform each electrical test and visual and mechanical inspection stated in manufacturer's installation instructions for molded-case circuit breakers. Certify compliance with test parameters.
2. Correct malfunctioning units on-site, where possible, and retest to demonstrate compliance; otherwise, replace with new units and retest.

3.5 CLEANING

- A. On completion of installation, inspect interior and exterior of panelboards. Remove paint splatters and other spots. Vacuum dirt and debris; do not use compressed air to assist in cleaning. Repair exposed surfaces to match original finish.

END OF SECTION 262416

SECTION 262726 - WIRING DEVICES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. This Section includes the following:
 - 1. Single and duplex receptacles and ground-fault circuit interrupter receptacles.
 - 2. Single- and double-pole snap switches and dimmer switches.
 - 3. Device wall plates.

1.3 DEFINITIONS

- A. GFCI: Ground-fault circuit interrupter.

1.4 SUBMITTALS

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

1.5 QUALITY ASSURANCE

- A. Source Limitations: Obtain each type of wiring device through one source from a single manufacturer.
- B. 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.
- C. Comply with NFPA 70.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. Wiring Devices:
 - a. Bryant Electric, Inc./Hubbell Subsidiary.
 - b. Eagle Electric Manufacturing Co., Inc.
 - c. Hubbell Incorporated; Wiring Device-Kellems.
 - d. Leviton Mfg. Company Inc.
 - e. Lutron.
 - f. Pass & Seymour/Legrand; Wiring Devices Div.

2.2 RECEPTACLES

- A. Straight-Blade-Type Receptacles: Comply with NEMA WD 1, NEMA WD 6, DSCC W-C-596G, and UL 498.
- B. Straight-Blade and Locking Receptacles:
 - 1. Heavy-Duty grade.
 - 2. Arranged for back and side wiring with brass screws.
 - 3. Grounding type with hex head ground screw terminal.
 - 4. 15-amp and 20-amp, 125-Volt and 250-Volt receptacles in damp or wet locations shall be listed weather-resistant type.
 - 5. Receptacles shall accommodate back and side wiring and shall be grounding type with separate single or double grounding screw terminals.
- C. Tamper-Resistant Convenience Receptacles, 125 V, 15 & 20 A: Comply with NEMA WD 1, NEMA WD 6 Configuration 5-20R, UL 498 Supplement sd, and FS W-C-596.
- D. GFCI Receptacles:
 - 1. Straight blade, feed-through type, Heavy-Duty grade, with integral NEMA WD 6, Configuration 5-20R duplex receptacle.
 - 2. Comply with UL 498 and UL 943.
 - 3. Design units for installation in a 2-3/4-inch- (70-mm-) deep outlet box without an adapter.

2.3 SWITCHES

- A. Single- and Double-Pole Switches: Comply with DSCC W-C-896F and UL 20.
- B. Snap Switches:
 - 1. Heavy-Duty grade, quiet type without the use of mercury switches.
 - 2. Arranged for back and side wiring with brass screws.
 - 3. Grounding type with hex head ground screw terminal.
- C. Dimmer Switches: Modular, full-wave, solid-state units with integral, quiet on/off switches and audible frequency and EMI/RFI filters.
 - 1. Control: Continuously adjustable slider; with single-pole or three-way switching to suit connections.

2.4 WALL PLATES

- A. Single and combination types to match corresponding wiring devices.
 - 1. Size: All plates shall be oversized / jumbo with matching vertical dimension.
 - 2. Plate-Securing Screws: Metal with head color to match plate finish.
 - 3. Material for Finished Spaces: 0.035-inch- (1-mm-) thick, satin-finished stainless steel.
 - 4. Material for Unfinished Spaces: Galvanized steel.

5. Material for Wet Locations: Cast aluminum, weatherproof, "in-use" type. Receptacle box covers shall be weatherproof whether or not a cord & plug are inserted or not.
6. Toggle Switch Serving as a Disconnect: Wallplate shall be configured with brackets on both sides of the switch to accommodate a padlock to secure the switch in the Off position.

2.5 FINISHES

A. Color:

1. Wiring Devices Connected to Normal Power System: White, unless otherwise indicated or required by NFPA 70.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Install devices and assemblies level, plumb, and square with building lines.
- B. Install tamper-resistant receptacles at locations as required by the NEC and/or the local authority having jurisdiction.
- C. Install wall dimmers to achieve indicated rating after derating for ganging according to manufacturer's written instructions.
- D. Install unshared neutral conductors on line and load side of dimmers according to manufacturers' written instructions.
- E. Arrangement of Devices: Mount flush unless noted otherwise:
 1. Receptacles over counters, backsplashes, etc. shall be mounted with long dimension horizontal.
 2. Otherwise, unless noted differently, mount with long dimension vertical, and with grounding terminal of receptacles on top.
 3. Group adjacent switches under single, multigang wall plates.
- F. Remove wall plates and protect devices and assemblies during painting.

3.2 IDENTIFICATION

- A. Comply with Section "Electrical Identification."
 1. Receptacles: Identify panelboard and circuit number from which served. Use hot, stamped / thermal printing with black-filled lettering on face of plate, and durable wire markers inside outlet boxes.

3.3 CONNECTIONS

- A. Ground equipment according to Section "Grounding and Bonding."
- B. Connect wiring according to Section "Conductors and Cables."

- C. Tighten electrical connectors and terminals according to manufacturer's published torque-tightening values. If manufacturer's torque values are not indicated, use those specified in UL 486A and UL 486B.

3.4 FIELD QUALITY CONTROL

- A. Perform the following field tests and inspections:
 - 1. After installing wiring devices and after electrical circuitry has been energized, test for proper polarity, ground continuity, and compliance with requirements.
 - 2. Test GFCI operation with both local and remote fault simulations according to manufacturer's written instructions.
- B. Remove malfunctioning units, replace with new units, and retest as specified above.

END OF SECTION 262726

SECTION 262816 - ENCLOSED SWITCHES AND CIRCUIT BREAKERS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. This Section includes the following individually mounted, enclosed switches and circuit breakers:
 - 1. Fusible switches.
 - 2. Nonfusible switches.
 - 3. Molded-case circuit breakers.
 - 4. Enclosures.

1.3 DEFINITIONS

- A. GFCI: Ground-fault circuit interrupter.
- B. HD: Heavy duty.
- C. RMS: Root mean square.

1.4 SUBMITTALS

- A. Product Data: For each type of enclosed switch, circuit breaker, accessory, and component indicated. Include dimensioned elevations, sections, weights, and manufacturers' technical data on features, performance, electrical characteristics, ratings, and finishes.
 - 1. Enclosure types and details for types other than NEMA 250, Type 1.
 - 2. Current and voltage ratings.
 - 3. Short-circuit current rating.
 - 4. Features, characteristics, ratings, and factory settings of individual overcurrent protective devices and auxiliary components.
- B. Manufacturer Seismic Qualification Certification: Submit certification that enclosed switches and circuit breakers, accessories, and components will withstand seismic forces defined in Section "Seismic Controls for Electrical System." Include the following:
 - 1. Basis of Certification: Indicate whether withstand certification is based on actual test of assembled components or on calculation.
 - a. The term "withstand" means "the unit will remain in place without separation of any parts from the device when subjected to the seismic forces specified."

- b. The term "withstand" means "the unit will remain in place without separation of any parts from the device when subjected to the seismic forces specified and the unit will be fully operational after the seismic event."
 - 2. Dimensioned Outline Drawings of Equipment Unit: Identify center of gravity and locate and describe mounting and anchorage provisions.
 - 3. Detailed description of equipment anchorage devices on which the certification is based and their installation requirements.
 - C. Field quality-control test reports including the following:
 - 1. Test procedures used.
 - 2. Test results that comply with requirements.
 - 3. Results of failed tests and corrective action taken to achieve test results that comply with requirements.
 - D. Operation and Maintenance Data: For enclosed switches and circuit breakers to include in emergency, operation, and maintenance manuals. If Section "Operation and Maintenance Data" is included in the project manual, in addition to items there, include the following:
 - 1. Manufacturer's written instructions for testing and adjusting enclosed switches and circuit breakers.
 - 2. Time-current curves, including selectable ranges for each type of circuit breaker.
 - 3. Circuit breaker trip settings.
- 1.5 QUALITY ASSURANCE
- A. 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.
 - B. Comply with NFPA 70.
- 1.6 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 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the manufacturers specified.

2.2 FUSIBLE AND NONFUSIBLE SWITCHES

- A. Manufacturers:

1. Eaton Corporation; Cutler-Hammer Products.
 2. General Electric Co.; Electrical Distribution & Control Division.
 3. Hubbell.
 4. Legrand.
 5. Siemens Energy & Automation, Inc.
 6. Square D/Group Schneider.
- B. Fusible Switch, 1200 A and Smaller: NEMA KS 1, Type HD, with clips or bolt pads to accommodate specified fuses, lockable handle with capability to accept two padlocks, and defeatable door interlocks when the operating handle is in the "ON" position. Short-circuit withstand ratings of 100kA or 200kA require Class R or Class J rejection fuse block feature.
- C. Nonfusible Switch, 1200 A and Smaller: NEMA KS 1, Type HD, lockable handle with capability to accept two padlocks, and defeatable door interlocks when the operating handle is in the "ON" position.
- D. Accessories:
1. Equipment Ground Kit: Internally mounted and labeled for copper and aluminum ground conductors.
 2. Neutral Kit: Internally mounted; insulated, capable of being grounded, and bonded; and labeled for copper and aluminum neutral conductors.

2.3 MOLDED-CASE CIRCUIT BREAKERS AND SWITCHES

- A. Manufacturers:
1. Eaton Corporation; Cutler-Hammer Products.
 2. General Electric Co.; Electrical Distribution & Control Division.
 3. Siemens Energy & Automation, Inc.
 4. Square D/Group Schneider.
- B. Molded-Case Circuit Breaker: NEMA AB 1, with interrupting capacity to meet available fault currents.
1. Thermal-Magnetic Circuit Breakers: Inverse time-current element for low-level overloads and instantaneous magnetic trip element for short circuits. Adjustable magnetic trip setting for circuit-breaker frame sizes 250 A and larger.
 2. Adjustable Instantaneous-Trip Circuit Breakers: Magnetic trip element with front-mounted, field-adjustable trip setting.
 3. Electronic Trip-Unit Circuit Breakers: RMS sensing; field-replaceable rating plug; with the following field-adjustable settings:
 - a. Instantaneous trip.
 - b. Long- and short-time pickup levels.
 - c. Long- and short-time time adjustments.
 - d. Ground-fault pickup level, time delay, and I²t response.
 4. GFCI Circuit Breakers: Single- and two-pole configurations.
 - a. 5-mA trip sensitivity for personnel protection.
 - b. 30-mA trip sensitivity for equipment protection.

C. Molded-Case Circuit-Breaker Features and Accessories:

1. Standard frame sizes, trip ratings, and number of poles.
2. Lugs: Mechanical style suitable for number, size, trip ratings, and conductor material.
3. Application Listing: Type SWD for switching fluorescent lighting loads; Type HACR for heating, air-conditioning, and refrigerating equipment.
4. Ground-Fault Protection: Integrally mounted relay and trip unit with adjustable pickup and time-delay settings, push-to-test feature, and ground-fault indicator.
5. Shunt Trip: Where indicated, 120-V trip coil energized from separate circuit.

2.4 ENCLOSURES

A. NEMA AB 1 and NEMA KS 1 to meet environmental conditions of installed location.

1. Outdoor Locations: NEMA 250, Type 4X stainless steel.
2. Other Wet or Damp Indoor Locations: NEMA 250, Type 4.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine elements and surfaces to receive enclosed switches and circuit breakers for compliance with installation tolerances and other conditions affecting performance.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

- A. Comply with applicable portions of NECA 1, NEMA PB 1.1, and NEMA PB 2.1 for installation of enclosed switches and circuit breakers.
- B. Mount individual wall-mounting switches and circuit breakers with tops at uniform height, unless otherwise indicated. Anchor floor-mounting switches to concrete base.
- C. Temporary Lifting Provisions: Remove temporary lifting eyes, channels, and brackets and temporary blocking of moving parts from enclosures and components.
- D. Comply with mounting and anchoring requirements specified in Section "Seismic Controls for Electrical System."

3.3 IDENTIFICATION

- A. Identify field-installed conductors, interconnecting wiring, and components; provide warning signs as specified in Section "Electrical Identification."
- B. Enclosure Nameplates: Label each enclosure with engraved metal or laminated-plastic nameplate as specified in Section "Electrical Identification."

3.4 FIELD QUALITY CONTROL

- A. Prepare for acceptance testing as follows:

1. Inspect mechanical and electrical connections.
2. Verify switch type and labeling verification.
3. Verify rating of installed fuses.
4. Inspect proper installation of type, size, quantity, and arrangement of mounting or anchorage devices complying with manufacturer's certification.

B. Perform the following field tests and inspections and prepare test reports:

1. Perform each electrical test and visual and mechanical inspection stated in manufacturer's installation instructions for switches and molded-case circuit breakers. Certify compliance with test parameters.
2. Test mounting and anchorage devices according to requirements in Section "Seismic Controls for Electrical Systems."
3. Correct malfunctioning units on-site, where possible, and retest to demonstrate compliance; otherwise, replace with new units and retest.

3.5 ADJUSTING

- A. Set field-adjustable switches and circuit-breaker trip ranges.
- B. Prepare documentation of circuit breaker trip settings for Owner record documents.

3.6 CLEANING

- A. On completion of installation, vacuum dirt and debris from interiors; do not use compressed air to assist in cleaning.
- B. Inspect exposed surfaces and repair damaged finishes.

END OF SECTION 262816

SECTION 264313 - SURGE PROTECTIVE DEVICES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. This Section includes UL 1449 Type 2 surge protective devices for low-voltage power.

1.3 SUBMITTALS

- A. Product Data: For each type of product indicated. Include rated capacities; shipping, installed, and operating weights; furnished specialties; and accessories.
- B. Product Certificates: Signed by manufacturers of surge protective devices, certifying that products furnished comply with the following testing and labeling requirements:
 - 1. UL 1283 certification.
 - 2. UL 1449 listing and classification.
- C. Field Test Reports: Written reports of tests specified in Part 3 of this Section. Include the following:
 - 1. Test procedures used.
 - 2. Test results that comply with requirements.
 - 3. Failed test results and corrective action taken to achieve requirements.
- D. Maintenance Data: For surge protection devices to include in maintenance manuals.
- E. Warranties: Special warranties specified in this Section.

1.4 QUALITY ASSURANCE

- A. Source Limitations: Obtain suppression devices and accessories through one source from a single manufacturer.
- B. Product Options: Drawings indicate size and dimensional requirements.
- C. Electrical Components, Devices, and Accessories: Listed and labeled by a third party agency that is accredited by the NCBCC (North Carolina Building Code Council) to label electrical & mechanical equipment.
- D. IEEE Compliance: Comply with:
 - 1. IEEE C62.41.1, "Guide on the Surge Environment in Low-Voltage (1000V and less) AC Power Circuits".

2. IEEE C62.41.2, "Recommended Practice on Characterization of Surges in Low-Voltage (1000V and less) AC Power Circuits".
3. IEEE C62.45, "Recommended Practice on Surge Testing for Equipment Connected to Low-Voltage (1000V and less) AC Power Circuits".
4. IEEE C62.72, "Guide for the Application of Surge Protective Devices for Low-Voltage (1000V and less) AC Power Circuits".
5. IEEE C62.45, "Standard Test Specifications for Surge Protective Devices for Low-Voltage (1000V and less) AC Power Circuits".

E. NEC Compliance: Comply with NEC 285, "Surge Protective Devices".

F. UL Compliance: Comply with:

1. UL 96A, "Installation Requirements for Lightning Protection Systems": Where UL Master Label Certification is required for a lightning protection system.
2. UL 1283, "Electromagnetic Interference Filters".
3. UL 1449, "Transient Voltage Surge Suppressors": latest edition.

1.5 PROJECT CONDITIONS

- A. Placing into Service: Do not energize or connect service entrance equipment and panelboards to their sources until the surge protective devices are installed and connected.
- B. Existing Utilities: Do not interrupt utilities serving facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary utility services according to requirements indicated:
1. Notify Architect/Engineer/Owner not less than two weeks in advance of proposed utility interruptions.
 2. Do not proceed with utility interruptions without Owner's written permission.

1.6 COORDINATION

- A. Verify voltage rating of system to be protected by surge protective device.
- B. Coordinate location of field-mounted surge suppressors to allow adequate clearances for maintenance.

1.7 WARRANTY

- A. General Warranty: Special warranties specified in this Article shall not deprive Owner of other rights Owner may have under other provisions of the Contract Documents and shall be in addition to, and run concurrent with, other warranties made by Contractor under requirements of the Contract Documents.
- B. Special Warranty: Written warranty, executed by manufacturer agreeing to repair or replace components of surge suppressors that fail in materials or workmanship within five years from date of Final Acceptance.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
1. Current Technology, Inc.
 2. ASCO.
 3. Thor Systems, Inc.

2.2 SERVICE ENTRANCE SUPPRESSORS

- A. Manufacturer Series:
1. Current Technology #TG3 Series.
 2. ASCO #460 Series.
 3. Thor Systems #TSri Series.
- B. Include the following features and accessories:
1. LED indicator lights for power and protection status.
 2. Surge Rating: 100kA per mode / 200KA per phase.
 3. ANSI / UL 1449 VPR:
 - a. 120/208V: 800V maximum (L-N, L-G, N-G), 1200V maximum (L-L).
 - b. 277/480V: 1200V maximum (L-N, L-G, N-G), 2000V maximum (L-L).
 4. Enclosures: NEMA 1.
 5. Surge-event operations counter.
- C. Connection Means: Permanently wired.
- D. Protection modes:
1. Line to Neutral.
 2. Line to Ground.
 3. Neutral to Ground.

2.3 PANELBOARD SUPPRESSORS

- A. Manufacturer Series:
1. Current Technology #CGP Series.
 2. ASCO #440 Series.
 3. Thor Systems #TSni Series.
- B. Include the following features and accessories:
1. LED indicator lights for power and protection status.
 2. Surge Rating: 100kA per mode.
 3. ANSI / UL 1449 VPR:
 - a. 120/208V: 800V maximum (L-N, L-G, N-G), 1200V maximum (L-L).
 - b. 277/480V: 1200V maximum (L-N, L-G, N-G), 2000V maximum (L-L).

4. Enclosures: NEMA 1.
5. Surge-event operations counter.

C. Connection Means: Permanently wired.

D. Protection modes:

1. Line to Neutral.
2. Line to Ground.
3. Neutral to Ground.

2.4 ENCLOSURES

- A. NEMA 250, with type matching the enclosure of panel or device being protected.

PART 3 - EXECUTION

3.1 INSTALLATION OF SURGE PROTECTIVE DEVICES

- A. Install devices at service entrance on load side, with ground lead bonded to service entrance ground. Use conductors between suppressor and points of attachment as short and straight as possible. Do not exceed manufacturer's recommended lead length.
1. Provide multipole, 60-A circuit breaker as a dedicated disconnect for the suppressor, unless otherwise indicated
- B. Install devices for panelboards with conductors between suppressor and points of attachment as short and straight as possible. Do not exceed manufacturer's recommended lead length. Do not bond neutral and ground.
1. Provide multipole, 30-A circuit breaker as a dedicated disconnect for the suppressor, unless otherwise indicated.

3.2 CONNECTIONS

- A. Tighten electrical connectors and terminals according to manufacturer's published torque-tightening values. If manufacturer's torque values are not indicated, use those specified in UL 486A and UL 486B.

3.3 FIELD QUALITY CONTROL

- A. Testing: Perform the following field quality-control testing:
1. After installing surge protective devices, but before electrical circuitry has been energized, test for compliance with requirements.
 2. Complete startup checks according to manufacturer's written instructions.
- B. Repair or replace malfunctioning units. Retest after repairs or replacements are made.

END OF SECTION 264313

DIVISION 26: ELECTRICAL

Section 26 50 00

ARCHITECTURAL LIGHTING FIXTURE SPECIFICATIONS

PART 1 - GENERAL

1.1 GENERAL REQUIREMENTS:

- A. Work of this section shall be governed by the Contract Documents. Provide materials, labor, equipment, and services necessary to furnish, deliver, and install all work of this section as shown on the drawings, as specified herein, and/or as required by job conditions.
- B. The work shall include but not be limited to the following:
 - 1. Complete shop fabrication
 - 2. Delivery to job site
 - 3. Installation at designated locations, and controls as noted
 - 4. Lamping and lamps
 - 5. Lamp focusing
 - 6. Cleaning and protection

1.2 DESCRIPTION OF WORK:

- A. Furnish and install a lighting fixture of the type indicated by the letter and/or number at each location shown on the drawings.
- B. All materials, accessories, and any other equipment necessary for the complete and proper installation of all lighting fixtures included in this Contract shall be furnished by the Contractor.
- C. Conformance: Fixtures shall be manufactured in strict accordance with the Contract Drawings and Specifications.
- D. Codes: Materials and installation shall be in accordance with the latest adopted version of any applicable national and local codes and regulations.
- E. Certification Listing: All fixtures shall be manufactured in strict accordance with the appropriate and current requirements of a nationally recognized testing laboratory including UL, ETL, and CSA. A certification mark shall be provided for each fixture type, and the appropriate labels shall be affixed to each fixture in a position concealing it from normal view.
- F. For EU and some Asian projects instead of UL. Certification Listing: All fixtures shall be manufactured in strict accordance with the appropriate and current requirements of the European Economic Area approved CE testing laboratory. A certification mark shall be provided for each fixture type, and the appropriate labels shall be affixed to each fixture in a position concealing it from normal view.
- G. Specifications and scale drawings are intended to convey the salient features, function and character of the fixtures only, and do not undertake to illustrate or set forth every item or detail necessary for the work.

- H. Minor details, not usually indicated on the drawings nor specified, but that are necessary for the proper execution and completion of the fixtures, shall be included, the same as if they were herein specified or indicated on the drawings.
- I. Omissions: The Owner shall not be held responsible for the omission or absence of any detail, construction feature, etc. which may be required in the production of the fixtures. The responsibility of accurately fabricating the fixtures to the fulfillment of this specification rests with the Contractor.

1.3 RELATED DOCUMENTS:

- A. Drawings and general provisions of Contract, including General and Supplementary General Conditions and other Division 01 specification sections, apply to this Section and to all Contractors, Subcontractors, or other persons supplying materials and/or labor, entering into the Project site and/or premises, directly, or indirectly.
- B. The Specifications and Drawings are intended to be complementary. A particular section, paragraph or heading in a Division may not describe each and every detail concerning work to be done and materials to be furnished. The Drawings are diagrammatic and may not show all of the work required or all construction details. All dimensions and actual placements are to be verified in the field. It is to be understood that the best trade practices of the Division will prevail. It remains the responsibility of the Contractor or Subcontractor to provide all items, equipment, construction, and services required to the proper execution and completion of the Work.
- C. Reference listings are provided as a convenience to the Contractor or Subcontractor providing the Work of this Section and may not contain all the requirements affecting this Section. It remains the responsibility of the Contractor or Subcontractor to locate and comply with all requirements of the Contract Documents.
- D. Refer the Lighting Fixture Schedule, Section 16500 – Appendix A, for specific fixture details. Any discrepancies between the catalog numbers, fixture descriptions, remarks, lamp and supply voltage should be brought to the attention of the Lighting Consultant prior to the release of a purchase order. Contractor is responsible for any coordination that may be required between trades and adjacent materials / construction.

1.4 REFERENCE STANDARDS:

- A. ANSI/NFPA 70 - National Electrical Code
- B. New York City Electrical Code
- C. New York City Building Code (and Reference Standards)
- D. Underwriters Laboratory (UL)
- E. National Electrical Manufacturers Association (NEMA)
- F. Uniform Building Code, 1988 Edition for Seismic Design Requirements
- G. Lighting fixtures: Section 47.1813 requires fixtures weighing less than 56 pounds to have two (2) number 12 hangers from the housing to the structure above; more than 56 pounds requires "approved" hanger pendant fixtures to be hung directly from the structure above.
- H. Aluminum Association (AA)
- I. American Iron and Steel Institute (AISI)

1.5 SUBMITTALS:

- A. Shop Drawings shall clearly indicate the contract drawing number of fixture details used as reference in the development of the shop drawings, and the names of the job, Architect and Lighting Consultant.
- B. The Contractor shall coordinate all his lighting fixture drawings with the drawings and details of the Architectural, Structural, Electrical, Mechanical, and other related trades to assure a perfect and efficient installation.
- C. No variation from the general arrangement and details indicated on the drawings shall be made on the shop drawings unless required to suit the actual conditions on the premises, and then only with the written approval of the Architect.
- D. Catalogue cuts lacking sufficient detail to indicate compliance with contract documents will not be acceptable.
- E. Timely submission: Shop drawings for all lighting fixtures shall be received no later than sixty days after award of Contract.
- F. Review of shop drawings or samples does not waive contract requirements.
- G. Photometric Data: Where indicated on the fixture schedule and contract drawings, supply complete photometric data for the fixture, including optical performance rendered by independent testing laboratory, developed according to methods of Illuminating Engineering Society of North America. For down and semi-down lights used for general illumination:
 - 1. Coefficients of utilization.
 - 2. Visual Comfort Probability data (fluorescent only for 100 foot-candles), rooms with reflectances of 80 percent (ceiling), 50 percent (walls), and 20 percent (floor), including a (20 ft. by 20 ft.) room with 10 ft. ceiling and luminaires lengthwise.
 - 3. Candlepower data, presented graphically and numerically, in 5 degree increments (5 degree, 10 degree, 15 degree, etc.). Data developed for up and down quadrants normal, parallel, and at 22-1/2°, 45°, 167-1/2° to lamps if light output is asymmetric.
 - 4. Zonal lumens stated numerically in 10 degree increments (5 degree, 15 degree, etc.) as above.
 - 5. For area and roadway luminaires isocandela charts, coefficients of utilization, and IES roadway distribution classification.
 - 6. Supply photometric data for any fixture offered in substitution for a specified fixture.

1.6 SHOP DRAWINGS:

- A. Submit shop drawings to the Architect for review in accordance with the requirements of the Contract Documents.
- B. Shop drawings shall include details and cuts of each fixture type scheduled herein, and shall include for each type the following information.
 - 1. Type, lamping, size, material exterior and interior, ballast type (where applicable), lenses, baffles, finishes, and means and methods of attachment.
 - 2. Include photometric data for each fixture.

3. Submit thermal test data for ballasts regarding the tripping class P units based on the specified criteria (Reference 2.02 C).
 - C. Submit reflected ceiling plans, sections and details so as to locate and define each fixture type and its location.
 - D. Clearly indicate work to be provided by other trade subcontractors and coordinate accordingly.
 - E. Indicate wiring and control circuits.
 - F. To accommodate the seismic requirements, indicate supplementary spring type supports from the buildings structure for all fixtures 2 foot square in area and above.
- 1.7 SAMPLES:
- A. After shop drawing approval, and prior to release for manufacturing, the Contractor shall furnish one sample of each fixture on the fixture schedule and contract drawings for which sample requirement is noted.
 - B. Shipping: The samples shall be complete with specified lamp(s) ready for hanging, energizing, and examining, and shall be shipped, prepaid by Contractor, to the Lighting Consultant, or as otherwise advised.
 - C. Sufficient time shall be allowed for thorough examination of the samples by the Lighting Consultant.
 - D. Samples are not returnable, nor included in quantities listed for a project.
 - E. Samples must be actual working unit of materials to be supplied.
- 1.8 QUALITY ASSURANCES:
- A. Qualifications
 1. The Manufacturer shall be a specialty lighting firm who has been in the business of designing and manufacturing specialty lighting fixtures for not less than ten (10) years.
 2. The Installer, if not the manufacturer, shall be a firm having trained personnel who have been in the business of installing specialty lighting for not less than seven (7) years and shall provide a full time field superintendent who shall be a representative of the installer during the installation and testing.
- 1.9 DELIVERY, STORAGE AND HANDLING:
- A. Deliver materials to the site ready for use in the manufacturer's original and unopened containers and packaging, bearing labels as to type of material, brand name, and manufacturer's name. Delivered material shall be identical to the reviewed submittals.
 - B. Store materials under cover in a dry and clean location, off the ground. Remove materials which are damaged, or otherwise not suitable for installation from the job site and replace with acceptable materials.
 - C. The fixtures shall be delivered to the job site fully fabricated and assembled and ready for installation. Lamps shall be shipped separately.
 - D. For luminaires incorporating Alzak cones or reflector/cones for protection pending completion of the installation: these components shall be supplied bulk packed in cartons separate from the luminaires. Unit packaging of cones or reflector/cones with luminaires is not acceptable.

1.10 WARRANTY:

- A. Installation checkout: Upon completion of initial system installation and fixture cleaning, the trade subcontractor shall notify the Architect that the system has been completed. At this time, the subcontractor shall verify that the installation has been done in full accordance with the design and specification and is in full and complete working order.
- B. The Trade Subcontractor and Manufacturer shall guarantee all lighting fixtures and major components, except lamps, for a period of one (1) year after acceptance of the project and final payment is made. The guarantee shall be in an acceptable form and shall be signed and notarized by a person or persons authorized to execute such a document on behalf of the company.

PART 2 - PRODUCTS

2.1 FIXTURE CONSTRUCTION (GENERAL):

- A. All materials, accessories, and other related fixture parts shall be new and free from defects which in any manner may impair their character, appearance, strength, durability and function, and be effectively protected from any damage or injury from the time of fabrication to the time of delivery and until final acceptance of the work.
- B. Enclosures: Fabricate fixture enclosures with a minimum of #20 gauge (0.0359 inch) thick cold rolled sheet steel. Enclosures may be constructed of other metals, provided they are equivalent in mechanical strength and acceptable for the purpose. Fabricate lighting fixtures to be finished in vitreous porcelain enamel from a minimum of #20 gauge enameling steel.
- C. Sheet Metal Work: All sheet metal work shall be free from tool marks and dents, and shall have accurate angles bent as sharp as compatible with the gauges of the required metal. All intersections and joints shall be formed true of adequate strength and structural rigidity to prevent any distortion after assembly.
- D. Housings shall be so constructed that all electrical components are easily accessible and replaceable without removing fixtures from their mountings, or disassembly of adjacent construction.
- E. Castings: All castings shall be exact replicas of the approved patterns and shall be free of sand pits, blemishes, scales and rust, and shall be smoothly finished. Tolerance shall be provided for any shrinkage of the metal castings in order that the finished castings will accurately fit in their designated locations.
- F. All lamp sockets in lighting fixtures shall be suitable for the indicated lamps and shall be set so that lamps are positioned in optically correct relation to all lighting fixture components. If adjustable socket positions are provided, socket should be preset in factory for lamp specified. If different socket positions are specified for same fixture, sockets shall be preset for each type, and cartons marked accordingly.
- G. All fixtures shall be completely wired at the factory.
- H. Mounting Frames and Rings: If ceiling system requires, each recessed and semi-recessed fixture shall be furnished with a mounting frame or ring compatible with the ceiling in which they are to be installed. The frames and rings shall be one piece or constructed with electrically-welded butt joints, and of sufficient size and strength to sustain the weight of the fixture.
- I. Lightplacement or cleaning.

2.2 REFLECTORS & TRIMS:

- A. Installation: Reflectors, reflector cones and visible trim of all lighting fixtures shall not be installed until completion of plastering, ceiling tile work, painting and general clean-up. They shall be carefully handled to avoid scratching or finger-printing and shall be, at the time of acceptance by the Owner, completely clean.
- B. All Alzak parabolic cones shall be guaranteed against discoloration for a minimum of ten years, and, in the event of premature discoloration, shall be replaced by the Manufacturer, including materials and the cost of labor. Reflectors for fluorescent fixtures using tri-phosphor lamp technology shall not produce a visible "rainbow" of light.
- C. Aluminum reflectors shall be finished specular, semi-specular, or diffuse as required and shall meet or exceed Alzak specifications. Minimum requirements of reflector finishes for interior and exterior service shall be as follows:

Minimum weight of coating per description of service.	Minimum reflectance per cent square inch.	Specular	Diffuse
Normal interior commercial service.	5.0	83.0	75.0
General interior industrial and exterior work reflector protected by glass covering.	7.5	82.0	73.0
Exterior industrial and commercial reflector not protected.	10.0	78.0	75.0
Exterior marine service reflector not protected.	13.0	78.0	65.0

D. LENSES:

1. Plastic for lenses and diffusers shall be formed of colorless 100% virgin acrylic as manufactured by Rohm & Haas, Dupont or as acceptable. The quality of the raw material must exceed IES, SPI, and NEMA Specifications by at least 100% which, as a minimum standard, shall not exceed a yellowness factor of 3 after 2,000 hours of exposure in the Fade-meter or as tested by an independent test laboratory. Acrylic plastic lenses and diffusers shall be properly cast, molded or extruded as specified, and shall remain free of any dimensional instability, discoloration, embrittlement, or loss of light transmittance for at least 15 years.
2. Glass used for lenses, refractors, and diffusers in incandescent lighting fixtures shall be tempered for high impact and heat resistance. The glass shall be crystal clear in quality with a transmittance of not less than 88%. For exterior fixtures use tempered Borosilicate glass tempered Corning #7740 or as acceptable. For fixtures directly exposed to the elements and aimed above the horizontal with a radiant energy of 4.16 watts per square inch or greater, use Vycor glass.
3. Where optical lenses are used, they shall be free from spherical and chromatic aberrations and other imperfections which may hinder the functional performance of the lenses.
4. Mechanical: All lenses, louvers, or other light diffusing elements shall be removable, but positively held so that hinging or other normal motion will not cause them to drop out.
5. Cleaning: All lenses shall be turned over to the Owner clean and free of dust.

E. LAMP HOLDERS:

1. Incandescent:
 - a. Body: porcelain;
 - b. Screw Shell: nickel-plated brass, prelubricated with silicone compound.
2. Fluorescent:
 - a. Body: white urea plastic
 - b. Contacts: silver-plated phosphor bronze.

F. FINISHES:

1. Painted Surfaces: Synthetic enamel, with acrylic, alkyd, epoxy, polyester, or polyurethane base, light stabilized, baked on at 350° Fahrenheit minimum, catalytically or photochemically polymerized after application.
2. White finishes: minimum of 85 percent reflectance.
3. Ceiling opening frames shall either be manufactured of non-ferrous metal, or be suitably rustproofed after fabrication.
4. Selection: Unless otherwise noted, finishes shall be as selected by the Architect.
5. Undercoat: Except for stainless steel give ferrous metal surfaces a five stage phosphate treatment or other acceptable base bonding treatment before final painting and after fabrication.

6. Unpainted non-reflecting surfaces shall be satin finished and coated with a baked-on clear lacquer to preserve the surface. Where aluminum surfaces are treated with an anodic process, the clear lacquer coating may be omitted.
7. Unpainted Aluminum Surfaces: Finish interior aluminum trims with an anodized coating of not less than 7 mg. per square inch, of a color and surface finish as selected by the Architect. Finish exterior aluminum and aluminum trims with an anodized coating of not less than 35 mg. per square inch, of a color and surface finish as selected by the Architect.
8. Porcelain Enamel Surfaces: Apply porcelain finishes smoothly. Finish shall be not less than 7.5 mils thick of non-yellowing, white, vitreous porcelain enamel with a reflectance of not less than 85%.

2.3 LAMPS:

- A. Manufacturer: Lamps shall be manufactured by General Electric, Philips, or Osram/Sylvania unless different manufacturer is specified. Unless otherwise noted, all lamps of a given fixture designation and lamp type shall be supplied by the same manufacturer.
- B. If a specific manufacturer is noted in the schedule, only that manufacturer shall be acceptable.
- C. Provide lamps for all lighting fixtures (furnished as part of the electric work).
- D. Incandescent and tungsten halogen lamps shall not be operated, other than for initial testing, prior to final inspection, lighting control programming and/or turnover of finished space to owner. If incandescent or tungsten halogen lamps are operated by the contractor during construction, all lamps must be replaced by the contractor prior to owner turn over.
- E. Compact fluorescent, linear fluorescent, metal halide and LED lamps shall not be operated, during construction, other than for initial testing, inspections, or control system programming, for a period of more than two (2) months prior to turn over of the finished space to the owner. If lamps are operated longer than two (2) months prior to owner turn over, all lamps must be replaced by the contractor.

2.4 LED LIGHTING:

- A. The luminaire shall provide power to the LED's in accordance with the LED manufacturers' recommended specifications. The thermal characteristics of the luminaire coupled with the specified current shall not exceed LED Manufacturers LM-80 testing temperature as defined by the LED manufacturer. LED's shall not be overdriven beyond the LED manufacturer's specified nominal voltages and currents.
- B. The fixture shall be designed to maintain LED junction temperatures below the LED manufacturer's specified maximum temperature in ambient air temperatures up to 120° F.
- C. Luminaire manufacturers shall only utilize LED's that have been tested in accordance with LM-80. The average color shift reported from the LM-80 test report at 6,000 hours and 45° Celsius shall be less than 0.0020 du'v'.
- D. All LED fixtures (100% of each lot) shall undergo a minimum eight-hour burn-in test during manufacturing.

- E. Manufacturer of LED systems shall maintain color consistency of white LEDs to +/- 200K and shall not exceed 3 SDCM (3 stem MacAdam binning). All LED's shall have a CRI of at least 80 with an R9 value greater than zero (0) unless otherwise specified on the fixture schedule.
- F. Luminaire shall exhibit 50,000 hours of life to 70% lumen output based on LM-80 data and extrapolated via the TM-21 calculation from 9000 hours of data at the testing temperature.
- G. Luminaire shall produce a candle power distribution curve as documented in all literature and IES files issued by the fixture manufacturer. Any deviations greater than 5% must be submitted for approval. All photometric reports must be in accordance with LM-79.
- H. Manufacturer shall provide optical performance, polar diagrams, and relevant luminance and illuminance photometric data based on test results from an independent testing lab in accordance with LM-79.
- I. Luminaire shall be approved by UL, CSA, or ETL.
- J. LED Luminaire manufacturers shall provide a Driver (power supply) that supplies stable DC power to the luminaire.
- K. Contractor must provide attic stock of LED fixtures as described in the fixture schedule. Submittals must note the quantities of attic stock provided by the Contractor for each fixture type for approval. Contractor to keep fixtures in original packaging and label all boxes with fixture type, manufacturer, catalog number, beam spread, color temperature and wattage. Attic stock fixtures must be stored in a temperature controlled location between 55° and 85° Fahrenheit. Owner to advise contractor of attic stock storage location.

2.5 BASE BID MANUFACTURERS (ALTERNATES):

- A. Base bid for lighting fixtures of manufacturers listed.
- B. Alternate manufacturers: Identification by means of manufacturers' names and catalog numbers is to establish basic features and performance standards. Any substitutions must meet or exceed these standards.
 - 1. Where a product is specified to be by a designated manufacturer with "or equal by" an alternate manufacturer, the alternate manufacturer's product must meet the specifications given for the designated product. If the alternate manufacturer listed does not have a product that will meet the specification, then his product will not be acceptable.
 - 2. Where a product is specified to be by a designated manufacturer with "or equal by" an alternate manufacturer, the design, including space allocation, has been confirmed around the designated manufacturer. It is the contractor's responsibility to verify and prove that the alternate manufacturer's equipment is complete with the same features, options, and photometric performance, as the designated manufacturer's equipment, and that it will fit and perform equally in the available space (wall, plenum, cove, floor, etc.).
- C. Qualifications:
 - 1. Within sixty days of placement of order, Contractor must furnish independent photometric tests for all alternative fixtures.
 - 2. At the request of the Lighting Designer, one (1) sample fixture of any alternate manufacturer's fixture is to be provide for review, at no cost to the owner.

3. If fixture fails to comply with specification requirements at that time, Contractor will furnish an acceptable fixture at no additional cost to the Owner, and with no delay to the project.

PART 3 - EXECUTION

3.1 INSTALLATION:

- A. Installation: Do not scale electrical drawings for exact location of the lighting fixtures. In general, the architectural drawings and reflected ceiling plans indicate the proper locations of lighting fixtures.
- B. Appurtenances: Install each fixture properly and safely. Furnish and erect hangers, rods, mounting brackets, supports, frames, and other equipment required.
- C. Coordination: Furnish lighting fixtures complete with appurtenances required for the proper, safe and distortion-free installation in the various surfaces in which they appear. Determine surface types from the Architectural drawings.
- D. Instructions: Each lighting fixture shall be packaged with complete installation instructions. Install lighting fixtures in strict conformance with manufacturer's recommendations and instructions.
- E. Rigidly align continuous rows of lighting fixtures for true in-line appearance.
- F. Pendant fixtures: Install pendant lighting fixtures plumb and at a height from the floor as specified on the drawings. In cases where conditions make this impractical, refer to the Architect for a decision. Use ball aligners and canopies on pendant fixtures unless noted otherwise.
- G. Do not install fixtures and/or parts such as finishing plates and trims for recessed fixtures until all plastering and painting that may mar fixtures' finish has been completed.
- H. Mechanical Rooms: Lighting fixture locations in mechanical and electrical equipment rooms are approximate. Coordinate mounting height and location of lighting fixtures to clear mechanical, electrical and plumbing equipment and to illuminate adequately meters, gauges and equipment.
- I. Support all lighting fixtures independently of duct work or piping.
- J. Concealment: Whenever a fixture or its hanger canopy is applied to a surface mounted outlet box, a finished canopy shall be utilized to conceal the outlet box.
- K. Splices in internal wiring shall be made with approved insulated "wire nut" type mechanical connectors, suitable for the temperature and voltage conditions to which they are subjected.
- L. All wire utilized for connections to or between individual lamp sockets and lamp auxiliaries (i.e., wires which do not constitute "through circuit" wiring) shall be suitable for temperature, current, and voltage conditions to which it is subjected.
- M. Secondary voltages shall be tested at the power supply unit, the connection to the fixture, and such other locations on the distribution system as necessary. The inductance at the point of connection to the fixtures must be within the manufacturer's allowable range.
- N. Install reflector cones, baffles, aperture plates, and decorative elements after installation of ceiling tiles, painting and general cleanup.
- O. Replace blemished, damaged or unsatisfactory fixtures as directed.

3.2 AIMING AND ADJUSTMENT:

- A. All adjustable lighting units shall be aimed, focused, locked, etc., by the Subcontractor under the observation of the Lighting Consultant. The Lighting Consultant shall confirm the number of crews (foreman and apprentice) to be provided. All aiming and adjusting shall be carried out after the entire installation is complete. All ladders, scaffolds, etc. required for access to the light fixtures shall be furnished by the Contractor. As aiming and adjusting is completed, locking set-screws and bolts and nuts shall be tightened securely.
- B. Night Work: Where possible, units shall be focused during the normal working day. However, where daylight interferes with seeing, aiming shall be accomplished at night. Subcontractor must budget appropriate man-hours and overtime, if required, to complete the process to the owners satisfaction.

3.3 CLEANUP:

- A. At the time of final acceptance by the Owner, all lighting fixtures shall have been thoroughly cleaned with materials and methods recommended by the manufacturers, all broken parts shall have been replaced, and all lamps shall be new and operative.

3.4 MAINTENANCE:

- A. The Contractor shall be responsible for obtaining from his supplying lighting manufacturers, for each type of lighting fixture, a recommended maintenance manual including:
 - 1. Tools required.
 - 2. Types of cleaners to be used.
- B. Replacement parts identification lists.
- C. Final, as-built shop drawings.
- D. Six (6) bound copies of this material shall be forwarded to the Owner.
- E. The Contractor shall be responsible for ordering an additional 10% of the specified lamps for Owner's stock.

3.5 WARRANTY:

- A. The Contractor shall warrant the fixture, its finishes, and all of its component parts, except ballasts, to be free from defects for a period of one year from date of acceptance if operated within rated voltage range. Replacement of faulty materials and the cost of labor required to make the replacement shall be the responsibility of the Contractor. Ballasts shall be warranted for two years.

END OF SECTION

DIVISION 26: ELECTRICAL

Section 265111

ARCHITECTURAL LIGHTING FIXTURE SCHEDULE AND TECHNICAL DATA SHEETS

END OF SECTION 26 51 11

**North Waterfront Park
PACKAGES 3 4 95% CONSTRUCTION DOCUMENTS**

LIGHTING FIXTURE SCHEDULE

TYPE	MANUFACTURER and CATALOG NUMBER	DESCRIPTION AND REMARKS
TC	<p>Bega Lighting 77 651 K3</p> <p>70 758 (180 glare shield) 19 593 (surf. mtd. wiring box - where req'd)</p> <p><u>Approved Equals:</u> We-ef FLC240 LED</p> <p>Lumenpulse Lumenbeam</p>	<p>Pole mounted floodlight with 10° beams spread and concentric ring louver for glare control. Fixture head is 9-1/2" diameter x 9" deep die-cast aluminum with stainless steel fasteners, integral stray light control cylinder, and glass optic. Range of angular adjustment is 360deg rotation x +90/-35deg tilt and is lockable. Fixture pivots on center point of its housing.</p> <p>*For installation on FollowSpot support structure use surface mounted wiring box.</p> <p>PROTECTION RATING: IP65</p> <p>FINISHES: *Housing finish to be black as verified by the Architect.</p> <p><u>LIGHT SOURCE</u></p> <p>SOURCE: LED CCT: 3000K CRI: 90+ LUMENS: 4236lm / each (delivered)</p> <p><u>POWER</u></p> <p>LOAD: 48.2 watts / each INPUT VOLTAGE: * Voltage to be as specified by the E.E.</p> <p><u>CONTROL</u></p> <p>Dimmed Fixture Dimming Range: 1% to 100% of full light output. Protocol: 0-10 volt (TVI)</p> <p><u>LOCATION:</u></p> <p>Event and Great Lawn</p> <p><u>INSTALLATION NOTES:</u></p> <p>1. Refer to mounting detail for information about the installation of this fixture</p>
•TC-1	<p>Bega Lighting 77 652 K3</p> <p>70 775 (concentric ring louver) 70 758 (180 glare shield) 19 593 (surf. mtd. wiring box - where req'd)</p> <p><u>Approved Equals:</u> We-ef FLC240 LED</p> <p>Lumenpulse Lumenbeam</p>	<p>Similar to TC except to have 25 °beams spread and concentric ring louver and 180° glare shield.</p> <p><u>LIGHT SOURCE</u></p> <p>SOURCE: LED CCT: 3000K CRI: 90+ LUMENS: 4236lm / each (delivered)</p> <p><u>POWER</u></p> <p>LOAD: 48.2 watts / each INPUT VOLTAGE: * Voltage to be as specified by the E.E.</p> <p><u>CONTROL</u></p> <p>Dimmed Fixture Dimming Range: 1% to 100% of full light output. Protocol: 0-10 volt (TVI)</p> <p><u>LOCATION:</u></p> <p>Event and Great Lawn</p>

● Indicates items added or revised since last issue

LIGHTING FIXTURE SCHEDULE

TYPE	MANUFACTURER and CATALOG NUMBER	DESCRIPTION AND REMARKS
• TC-2	Bega Lighting 77 653 K3	Similar to TC except to have 50° beamsread and 180° glare shield
	70 758 (180 glare shield) 19 593 (surf. mtd. wiring box - where req'd)	LIGHT SOURCE SOURCE: LED CCT: 3000K CRI: 90+ LUMENS: 4236lm / each (delivered)
	Approved Equals: We-ef FLC240 LED	POWER LOAD: 48.2 watts / each INPUT VOLTAGE: * Voltage to be as specified by the E.E.
	Lumenpulse Lumenbeam	CONTROL Dimmed Fixture Protocol: 0-10 volt (TVI) Dimming Range: 1% to 100% of full light output.
		LOCATION: Event and Great Lawn
TG	Lucifer FRAXION 4 F4RTFS-2-00-WH-90C-19A-2-3-NIC- AN4 WITH 02/08	FLUSH round trim recessed LED downlight with integral 0-10V dimmable driver. Aperture dimensions are 4.25" round diameter bevel trim aperture with frosted soft focus len and honeycomb louver. Fixture housing dimensions are 7.0" width x 18" length x 4.5" depth.
	Coordination of certain aspects of this fixture is required	FINISHES: *Fixture finish to be white as verified by the Architect.
	Approved Equals: USAI BeveLED Mini	TRIM TYPE: Flangeless
	LF Illumination VF 150	Additional coordination is required on the following items: fixture trim and method of mounting with ceiling construction; refer to notes at the end of the schedule for additional details.
		LIGHT SOURCE SOURCE: LED CCT: 3000K CRI: 90+ LUMENS: 1357lm / each (delivered)
		POWER LOAD: 21 watts / each INPUT VOLTAGE: 120-277 universal voltage
		CONTROL Dimmed Fixture Protocol: 0-10 volt (TVI) Dimming Range: 10% to 100% of full light output.
		LOCATION: VIP Vestibule 142
		INSTALLATION NOTES: REFER TO NOTE AT THE END OF THE SCHEDULE ABOUT: Flush Ceiling Trim Installation

• Indicates items added or revised since last issue

LIGHTING FIXTURE SCHEDULE

TYPE	MANUFACTURER and CATALOG NUMBER	DESCRIPTION AND REMARKS
TH	Amerlux GRÜV4-HE-FLG-GRID*-A16-PL-7- 92**-HW-IND***-0-10V	Recessed linear LED with frosted white lens and integral 010V dimmable driver. Fixture dimensions are 3-3/16" W x 4" H x ***continuous runs as shown on drawings and as verified in field by contractor. Fixture to have 9/16" flat tee on both sides. *Architect to verify ACT ceiling is compatible. **Fixture to be 92CRI.
	Coordination of certain aspects of this fixture is required	FINISHES: *Trim finish to be white as verified by the Architect.
	Provide detailed fabrication drawings with submittal	TRIM TYPE: Overlap
	<u>Approved Equals:</u>	Additional coordination is required on the following items: fixture lengths, fixture trim and method of mounting with ceiling construction; refer to notes at the end of the schedule for additional details.
	Selux	
	M60	Provide detailed fabrication drawings with submittal.
	Lumenwerx	Drawings to include run lengths / layouts (with field verified dimensions), all conditions requiring coordination, layout of all fixture components including: individual housing lengths, cross section details, power supply(s) and feed locations, suspension details, and other items.
	Via 2	
		TESTING FOR COMPATABILITY WITH APPROVED CONTROL SYSTEM IS REQUIRED; MANUFACTURER TO COORDINATE, AND TO PROVIDED DOCUMENTATION OF ACCEPTABILITY
		<u>LIGHT SOURCE</u>
	SOURCE: LED	CCT: 3000K CRI: 92+ LUMENS: 719lm / ln.ft. (delivered)
		<u>POWER</u>
	LOAD: 7 watts / ln.ft.	INPUT VOLTAGE: 120-277 universal voltage
		<u>CONTROL</u>
	Dimmed Fixture Protocol: 0-10 volt (TVI)	Dimming Range: 1% to 100% of full light output.
		<u>LOCATION:</u>
		Catering 100, Park Office 101, Private Office 106
		<u>INSTALLATION NOTES:</u>
		REFER TO NOTES AT THE END OF THE SCHEDULE ABOUT: Continuous Fixture Runs, connection to power; LED - Uniform Spacing; and 0-10v Control

TYPE	MANUFACTURER and CATALOG NUMBER	DESCRIPTION AND REMARKS						
TH-1	Amerlux GRÜV4-HE-GB-A16-PL-7-92**-HW-IND***-0-10V Coordination of certain aspects of this fixture is required Provide detailed fabrication drawings with submittal <u>Approved Equals:</u> Selux M60 Lumenwerx Via 2	<p>Similar to Type TH, except to have mud-flange trimless installation.</p> <p>Additional coordination is required on the following items: fixture lengths, fixture trim and method of mounting with ceiling construction; refer to notes at the end of the schedule for additional details.</p> <p>Provide detailed fabrication drawings with submittal.</p> <p>Drawings to include run lengths / layouts (with field verified dimensions), all conditions requiring coordination, layout of all fixture components including: individual housing lengths, cross section details, power supply(s) and feed locations, suspension details, and other items.</p> <p><u>LIGHT SOURCE</u></p> <table> <tr> <td>SOURCE: LED</td><td>CCT: 3000K CRI: 92+ LUMENS: 719lm / each (delivered)</td></tr> </table> <p><u>POWER</u></p> <table> <tr> <td>LOAD: 7 watts / each</td><td>INPUT VOLTAGE: 120-277 universal voltage</td></tr> </table> <p><u>CONTROL</u></p> <table> <tr> <td>Dimmed Fixture Protocol: 0-10 volt (TVI)</td><td>Dimming Range: 1% to 100% of full light output.</td></tr> </table> <p><u>LOCATION:</u></p> <p>Box Office 105</p> <p><u>INSTALLATION NOTES:</u></p> <p>REFER TO NOTES AT THE END OF THE SCHEDULE ABOUT: LED - UniformSpacing; Continuous Fixture Runs, connection to power; 0-10v Control; and Flush Ceiling Trim Installation</p>	SOURCE: LED	CCT: 3000K CRI: 92+ LUMENS: 719lm / each (delivered)	LOAD: 7 watts / each	INPUT VOLTAGE: 120-277 universal voltage	Dimmed Fixture Protocol: 0-10 volt (TVI)	Dimming Range: 1% to 100% of full light output.
SOURCE: LED	CCT: 3000K CRI: 92+ LUMENS: 719lm / each (delivered)							
LOAD: 7 watts / each	INPUT VOLTAGE: 120-277 universal voltage							
Dimmed Fixture Protocol: 0-10 volt (TVI)	Dimming Range: 1% to 100% of full light output.							

TDA Project No: 2018-8050

LIGHTING FIXTURE SCHEDULE

TYPE	MANUFACTURER and CATALOG NUMBER	DESCRIPTION AND REMARKS
TK	Amerlux LIN2.5D-A16-PL-SM-7-92*-HW- IND**-0-10V	Surface mounted linear LED with frosted white lens and integral 010V dimmable driver in architectural pocket. Fixture dimensions are 2-11/16" W x 3-1/2" H x **continuous runs as shown on drawings and as verified in field contractor. *Fixture to be 92CRI.
	Coordination of certain aspects of this fixture is required	See sketch for additional information
	Approved Equals:	FINISHES: *Trim finish to be white as verified by the Architect.
	Selux	Additional coordination is required on the following items: fixture lengths; refer to notes at the end of the schedule for additional details.
	M125 Direct	
	Lumenwerx	LIGHT SOURCE
	Via 2	SOURCE: LED CCT: 3000K CRI: 92+ LUMENS: 719lm / ln.ft. (delivered)
		POWER
		LOAD: 7 watts / ln.ft. INPUT VOLTAGE: 120-277 universal voltage
		CONTROL
		Dimmed Fixture Dimming Range: 1% to 100% of full light output. Protocol: 0-10 volt (TVI)
		LOCATION:
		Exterior Vestibule and Box Office 105
		INSTALLATION NOTES:
		REFER TO NOTES AT THE END OF THE SCHEDULE ABOUT: 0-10v Control; Continuous Fixture Runs, connection to power; and LED - Uniform Spacing
TK-1	Amerlux LIN2.5D-A16-PL-SM-10-92*-HW- IND**-0-10V	Similar to Type TK-1, except to have higher lumen output.
	Approved Equals:	LIGHT SOURCE
	Selux	SOURCE: LED CCT: 3000K CRI: 92+ LUMENS: 968lm / each (delivered)
	M125 Direct	POWER
	Lumenwerx	LOAD: 10 watts / each INPUT VOLTAGE: * Voltage to be as specified by the E.E.
	Via 2	LOCATION:
		VIP Vestibule 142

LIGHTING FIXTURE SCHEDULE

TYPE	MANUFACTURER and CATALOG NUMBER	DESCRIPTION AND REMARKS
TM- ALT	Targetti KEPLERO MINI ZOOM KPLM-10-ZM-L2-30-1E25251DU2521	FLUSH recessed in-grade LED accent light with integral 0-10V dimmable driver. Nominal fixture dimensions are 6.625" diameter x 8" D with 20° tilt and 350° rotation and zoom optics (15°, 32°, 53°, and 63°) and with a round brushed natural aluminum stainless steel*. Fixture to be IP68 wet location listed. Fixture to be installed with half-moon antiglare shield and with modified anti-slip glass lens.
	1DU2530 (direct burial j-box)	
	1E2523 (anti glare half moon)	
	1E0388 (glass suction)	
	1E2495 (tool)	
		FINISHES: *Trim finish to be stainless steel as verified by the Architect.
		TRIM TYPE: Flush
	MOD - provide anti-slip glass lens	
	Provide all components necessary for a complete installation	
		LIGHT SOURCE
		SOURCE: LED CCT: 3000K CRI: 90+ LUMENS: 628lm / each (delivered)
		POWER
	Approved Equals:	
	We-ef	LOAD: 15 watts / each INPUT VOLTAGE: 120-277 universal voltage
	ETC-120	
		CONTROL
	Erco	Dimmed Fixture Dimming Range: 1% to 100% of full light output.
	Tesis	Protocol: 0-10 volt (TVI)
		LOCATION:
		Canopy Columns

● Indicates items added or revised since last issue

LIGHTING FIXTURE SCHEDULE

TYPE	MANUFACTURER and CATALOG NUMBER	DESCRIPTION AND REMARKS
TP	Amerlux LIN2.5D-A16-PL-WM-7-92*-HW- IND**0-10V Coordination of certain aspects of this fixture is required Provide detailed fabrication drawings with submittal <u>Approved Equals:</u> Selux M125 Direct Lumenwerx Via 2	Wall mounted linear LED with frosted white lens and integral 010V dimmable driver. Fixture dimensions are 2-11/16" W x 3-1/2" H x **continuous runs as shown on drawings and as verified in field contractor. *Fixture to be 92CRI. Fixture to be moutned as high as possible but below mechanical devices, see architectural drawings for elevations. FINISHES: *Fixture finish to be white as verified by the Architect. Additional coordination is required on the following items: fixture lengths; refer to notes at the end of the schedule for additional details. Provide detailed fabrication drawings with submittal. Drawings to include run lengths / layouts (with field verified dimensions), all conditions requiring coordination, layout of all fixture components including: individual housing lengths, cross section details, power supply(s) and feed locatations, suspension details, and other items. <u>LIGHT SOURCE</u> not applicable <u>POWER</u> LOAD: 7 watts / ln.ft. INPUT VOLTAGE: 120-277 universal voltage <u>CONTROL</u> Dimmed Fixture Protocol: 0-10 volt (TVI) Dimming Range: 1% to 100% of full light output. <u>LOCATION:</u> Men's Lav 102, Women's Lav 104
TP-1	Amerlux <u>Approved Equals:</u> Selux M125 Direct Lumenwerx Via 2	Similar to Type TP, except to be pendant mounted. <u>LIGHT SOURCE</u> SOURCE: LED CRI: 80+ R9: 3+ <u>POWER</u> INPUT VOLTAGE: * Voltage to be as specified by the E.E.

● Indicates items added or revised since last issue

LIGHTING FIXTURE SCHEDULE

TYPE	MANUFACTURER and CATALOG NUMBER	DESCRIPTION AND REMARKS
TQ	<p>Reggiani Trybeca Round A.BC0EK.HQ12.12.V.OMR01.162*</p> <p>Coordination of certain aspects of this fixture is required</p> <p>Approved Equals:</p> <p>DMF Lighting DRD5S 8"</p> <p>USAI BeveLED 2.2</p>	<p>Flush lens LED downlight with integral 0-10V. Fixture has 6" diameter aperture and housing dimensions are 15" length x 11.4" width x 6.6" depth. Fixture to be installed in the FLUSH position. *Electrical engineer to advise driver voltage.</p> <p>FINISHES: *Trim finish to be white as verified by the Architect.</p> <p>TRIM TYPE: Overlap</p> <p>Additional coordination is required on the following items: fixture trim and method of mounting with ceiling construction; refer to notes at the end of the schedule for additional details.</p> <p>LIGHT SOURCE</p> <p>SOURCE: LED CCT: 3000K CRI: 90+ LUMENS: 2744lm / each (delivered)</p> <p>POWER</p> <p>LOAD: 24 watts / each INPUT VOLTAGE: 120-277 universal voltage</p> <p>CONTROL</p> <p>Dimmed Fixture Protocol: 0-10 volt (TVI) Dimming Range: 1% to 100% of full light output.</p> <p>LOCATION:</p> <p>Entry 107</p>
TQ-1	<p>Reggiani Trybeca Round A.CC0EK.HW12.12.V.OMR01.162*</p> <p>Coordination of certain aspects of this fixture is required</p> <p>Approved Equals:</p> <p>DMF Lighting DRD5S 8"</p> <p>USAI BeveLED 2.2</p>	<p>Similar to Type TQ, except to have trimless mud-flange installation.</p> <p>TRIM TYPE: Flush</p> <p>Additional coordination is required on the following items: fixture trim and method of mounting with ceiling construction; refer to notes at the end of the schedule for additional details.</p> <p>LIGHT SOURCE</p> <p>SOURCE: LED CCT: 3000K CRI: 90+ LUMENS: 1155lm / each (delivered)</p> <p>POWER</p> <p>LOAD: 24 watts / each INPUT VOLTAGE: 120-277 universal voltage</p> <p>CONTROL</p> <p>Dimmed Fixture Protocol: 0-10 volt (TVI) Dimming Range: 1% to 100% of full light output.</p> <p>LOCATION:</p> <p>VIP Women's Lav 173 and VIP Men's Lav 174</p> <p>INSTALLATION NOTES:</p> <p>REFER TO NOTE AT THE END OF THE SCHEDULE ABOUT: LED - UniformSpacing</p>

● Indicates items added or revised since last issue

LIGHTING FIXTURE SCHEDULE

TYPE	MANUFACTURER and CATALOG NUMBER	DESCRIPTION AND REMARKS
TR	<p>Martin by Harman VC-Grid 60 P/N 90357560 P/N 90357570 as required</p> <p>Remote driver required</p> <p>Provide all components necessary for a complete installation</p> <p>Coordination of certain aspects of this fixture is required</p> <p>Provide detailed fabrication drawings with submittal</p> <p>Remote dimmable driver (provided by Fixt. Mfr.) required</p> <p><u>Approved Equals:</u></p> <p>Traxon 64PXL Board RGB 2.0</p> <p>Nanometer Lighting Planar C</p>	<p>Surface mounted RGBW LED panel with remote DMX control driver, each LED diode to be individually controlled. Fixture dimensions are nominal 8" x 8" panels or as required for installation with a 60mm pixel pitch and 64 individually controllable pixels. Fixture to be installed in dry location and LED board to be white and to be mounted to substrate by others, contractor to coordinate. LED boards to be accessible.</p> <p>Note: Fixture commissioning will require program integrator and coordination with overriding control system, contractor to provide all control components.</p> <p>DETAILED SUBMITTAL to INCLUDE: input, cables, extension, output/throughput cables and all other required components for a complete installation, and coordination with glazing / mullion shop drawings</p> <p>FINISHES: *Fixture finish to be white as verified by the Architect.</p> <p>Additional coordination is required on the following items: drivers, fixture lengths, connection(s) to power; refer to notes at the end of the schedule for additional details.</p> <p><u>LIGHT SOURCE</u></p> <p>SOURCE: LED CCT: 3000K CRI: 90+ LUMENS: 840lm / sq.ft. (delivered)</p> <p><u>POWER</u></p> <p>LOAD: 60 watts / sq.ft INPUT VOLTAGE: pri: 120-277 universal voltage sec: 48 volts</p> <p>Dimmable driver(s) are remote</p> <p><u>CONTROL</u></p> <p>Dimmed Fixture Dimming Range: 1% to 100% of full light output. Protocol: DMX512-RDM</p> <p><u>LOCATION:</u></p> <p>Laboratories</p> <p><u>INSTALLATION NOTES:</u></p> <p>REFER TO NOTE AT THE END OF THE SCHEDULE ABOUT: Remote Driver</p>

LIGHTING FIXTURE SCHEDULE

TYPE	MANUFACTURER and CATALOG NUMBER	DESCRIPTION AND REMARKS
TW	<p>Lucifer FRAXION 4 F4RTWW-2-VWH-90C-19A-2-VWW- NIC-AN4</p> <p>Coordination of certain aspects of this fixture is required</p> <p><u>Approved Equals:</u> USAI Bevel LED Mini</p> <p>LF Illumination VF150</p>	<p>FLUSH round trimless recessed LED downlight with integral 0-10V dimmable driver. Aperture dimensions are 4.25" round diameter bevel trim aperture. Fixture housing dimensions are 7" width x 18" length x 4.5" depth.</p> <p>FINISHES: *Fixture finish to be white as verified by the Architect.</p> <p>TRIM TYPE: Flangeless</p> <p>Additional coordination is required on the following items: fixture trim and method of mounting with ceiling construction; refer to notes at the end of the schedule for additional details.</p> <p><u>LIGHT SOURCE</u></p> <p>SOURCE: LED CCT: 3000K CRI: 90+ LUMENS: 933lm / each (delivered)</p> <p><u>POWER</u></p> <p>LOAD: 21 watts / each INPUT VOLTAGE: 120-277 universal voltage</p> <p><u>CONTROL</u></p> <p>Dimmed Fixture Dimming Range: 10% to 100% of full light output. Protocol: 0-10 volt (TVI)</p> <p><u>LOCATION:</u></p> <p>VIP Vestibule 175</p> <p><u>INSTALLATION NOTES:</u></p> <p>REFER TO NOTES AT THE END OF THE SCHEDULE ABOUT: Flush Ceiling Trim Installation; and 0-10v Control</p>
TX	<p>Bega Lighting 66 978 - BLK*</p> <p><u>Approved Equals:</u> Arcluce Intis</p> <p>BK Lighting Denali</p>	<p>Surface mounted 3000°K LED cylinder with integral 0-10V dimmable driver. Cylindrical housing is 3.24" diameter x 7-1/2" housing x 6-1/2" depth. *Exterior finish to be black or as determined by Architect,</p> <p>INSTALLATION NOTES: 1. Refer to architectural and lighting details for mounting instructions. 2. Engineer to confirm dimming capability of dimming control system with dimmable load type.</p> <p><u>LIGHT SOURCE</u></p> <p>SOURCE: LED CCT: 3000K CRI: 80+ LUMENS: 1805lm / each (delivered)</p> <p><u>POWER</u></p> <p>LOAD: 26 watts / each INPUT VOLTAGE: * Voltage to be as specified by the E.E.</p> <p><u>CONTROL</u></p> <p>Dimmed Fixture Dimming Range: 1% to 100% of full light output. Protocol: 0-10 volt (TVI)</p> <p><u>LOCATION:</u></p> <p>Loading Dock</p>

● Indicates items added or revised since last issue

LIGHTING FIXTURE SCHEDULE

TYPE	MANUFACTURER and CATALOG NUMBER	DESCRIPTION AND REMARKS
TY	Bega Lighting 33 053 K3 BLK	Wall recessed shielded step light. Fixture has is 6-5/8" L x 2-3/4" W x 5" deep. Fixture to be to be IP65 wet location rated. Fixture to be mounted 18" AFF.
	Coordination of certain aspects of this fixture is required	FINISHES: *Fixture finish to be black as verified by the Architect.
	<u>Approved Equals:</u>	Additional coordination is required on the following items: connection(s) to power; refer to notes at the end of the schedule for additional details.
	Erco	
	Axis Walklight/Visor/Lightmark	<u>LIGHT SOURCE</u>
	Cole Lighting	SOURCE: LED
	600 Series	CCT: 3000K CRI: 80+ LUMENS: 231lm / each (delivered)
		<u>POWER</u>
		LOAD: 4.2 watts / each
		INPUT VOLTAGE: * Voltage to be as specified by the E.E.
		<u>CONTROL</u>
		Dimmed Fixture
		Protocol: 0-10 volt (TVI)
		Dimming Range: 1 % to 100% of full light output.
		<u>LOCATION:</u>
		Stairs and VIP Terrace 177

● Indicates items added or revised since last issue

LIGHTING FIXTURE SCHEDULE

TYPE	MANUFACTURER and CATALOG NUMBER	DESCRIPTION AND REMARKS
•TZ	<p>LED-Linear VarioLED HYDRA-HD25-W8-22-*- IP67</p> <p>with VarioContour 0016, 10000040- 15d (mounting bracket), 12000031 (linear lens, diffuse 60) and 0-10V dimmable driver</p> <p>Provide all components necessary for a complete installation including: include all required cables and connectors for a complete installation and mounting accessories as required</p> <p>Coordination of certain aspects of this fixture is required</p> <p>Provide detailed fabrication drawings with submittal</p> <p>Remote dimmable driver (provided by Fixt. Mfr.) required</p> <p><u>Approved Equals:</u></p> <p>Luminii Bosca Wet</p> <p>Q-Tran Boxa-SW</p>	<p>Surface mounted LED strip with delivered 2900°K CCT and wet location IP67 rating. Fixture di-mensions are 0.79" (width) x 0.78" (height) x continuous tandem lengths as shown in drawings and verified in field by Contractor. Fixture comes with 60° linear diffuse lens, aluminum mounting bracket with 15° angle, mounting clips, as required, and remote 0-10V dimmable drivers. Fixtures to be integrated into architectural pocket at guardrail curb base, see architectural drawings for details.</p> <p>Additional coordination is required on the following items: drivers, fixture lengths; refer to notes at the end of the schedule for additional details.</p> <p>Provide detailed fabrication drawings with submittal. Drawings to include run lengths / layouts (with field verified dimensions), all conditions requiring coordination, layout of all fixture components including: individual housing lengths, cross section details, power supply(s) and feed locations, suspension details, and other items.</p> <p>LIGHT SOURCE</p> <p>SOURCE: LED</p> <p>CCT: 2900K CRI: 90+ LUMENS: 581lm / ln.ft. (delivered)</p> <p>POWER</p> <p>LOAD: 7.6 watts / ln.ft.</p> <p>INPUT VOLTAGE: pri: * Voltage to be as specified by the E.E. sec: 24 volts</p> <p>Dimmable driver(s) are remote</p> <p>CONTROL</p> <p>Dimmed Fixture Protocol: 0-10 volt (TVI)</p> <p>Dimming Range: 1% to 100% of full light output.</p> <p>LOCATION:</p> <p>VIP Terrace</p> <p>INSTALLATION NOTES:</p> <p>REFER TO NOTES AT THE END OF THE SCHEDULE ABOUT: 0-10v Control; Continuous Fixture Runs, connection to power; LED - Uniform Spacing; and Remote Driver</p>

PROJECT NOTES:

GENERAL NOTES:

All fixtures must be approved by UL, CSA or ETL

Any discrepancies between the catalog number, fixture description, remarks, lamp and supply voltage should be brought to the attention of the lighting consultant prior to the release of a purchase order.

Catalog cuts or "Series" numbers are intended to provide assistance in establishing general type or category of lighting fixtures only. Contractor shall provide a fixture that meets the written performance and description.

Contractor to coordinate fixture and fixture trim with ceiling type, thickness and suspension and furnish all necessary mounting hardware and accessories. Any discrepancies between the catalog housing type and trim and ceiling type should be brought to the attention of the lighting consultant prior to the release of a purchase order.

Fabrication Drawings

Drawings to include run lengths / layouts (with field verified dimensions), edge / trim conditions, all conditions requiring coordination, layout of all fixture components including: individual housing lengths, cross section details, power supply(s) and feed locations, suspension details, and other items.

COORDINATION NOTES

Ceiling Type and Construction

- Indicates items added or revised since last issue

LIGHTING FIXTURE SCHEDULE

TYPE	MANUFACTURER and CATALOG NUMBER	DESCRIPTION AND REMARKS
		Fixture trim, mounting type (overlap flange / flush trim / or other) are to be coordinated by Contractor with the approved ceiling type and construction
	Fixture Length	Fixture lengths and quantities to be coordinated by the contractor with the architectural drawings and field verified with as-built conditions. Bring to the attention of the design team any significant variances in lengths, or layouts
	Power Connection	At all tandem mounted fixtures, all in-line power connection location(s), type(s) and the orientation of the connections are to be coordinated by the Contractor with the installation conditions so that housings butt with no gaps, or interruptions, assuring continuous light for full length of run.
	Remote Driver	Quantity, type, and size of drivers required, length and type of factory-attached secondary power lead to the fixture (REQUIRED, unless otherwise reviewed and approved by the manufacturer), and when necessary, method of connection to additional secondary cable (to be provided by the Contractor) are to be coordinated by the Contractor with the Fixture Manufacturer
	Suspension	Method, quantity, location, and length of fixture suspension (rod, cable, or other) and power / control cables are to be coordinated by the Contractor. When using rigid stem, Contractor to review the ability for field-cutting stem lengths; and if not possible, to coordinate required length(s) with architectural elevations and field conditions. Multiple lengths may be required within a single run and between adjacent fixtures mounted at the same height. When the power supply / control signal cables are independent of the suspension method (i.e. suspension is by stainless steel aircraft cable), all cables must be from the location(s) indicated on the drawings (typically at the "rear" side of the space); request direction if absent. Include Manufacturer's cable guides; if not available, nylon tie fasteners (of the same color as the cable) should be used).

INSTALLATION NOTES:

0-10v Control

The installation of low voltage control wire for fixtures utilizing a 0-10 volt protocol, requires the Contractor to have a thorough understanding of NEMA 410-2011, and IEC 60929) Control cable must run fixture - to - fixture; branch wiring (T-tapping) is not acceptable. Voltage drop should be kept to 0.3V or lower. Maximum digital wire loop length must not exceed the driver manufacturer's recommendations. Maximum number of drivers per loop must not exceed the driver manufacturer's recommendations. Polarity must be maintained throughout the installation, including at the connection to the driver (purple to +, grey to -). Other influences such as noise, inductances, and/or line voltage coupling must be accounted for. AN INCORRECTLY INSTALLED SYSTEM WILL RESULT IN CONTROL ERRORS AND WILL NOT BE ACCEPTABLE.

Focusing Required

Upon completion of construction, with all surface finishes complete, and FF&E (including any artwork and/or other accessories) in place, the Lighting Designer shall observe and direct the Contractor on the final targeting of all adjustable fixtures, including the installation / adjustment of any optical and/or mounting accessories. The labor after hours to complete this task, including the provision and/or coordinate of a lift, ladder and all other necessary equipment required to access the fixtures, and, the moving of furniture (as necessary), will be provided by the Contractor. Focusing may potentially be required after sunset; the Contractor will be responsible for all necessary coordination and accommodations.

LIGHTING FIXTURE SCHEDULE

TYPE	MANUFACTURER and CATALOG NUMBER	DESCRIPTION AND REMARKS
	Remote Driver	<p>Drivers are to be mounted in a well ventilated and accessible location coordinated by the contractor, and approved by the Architect. Contractor to provide NEMA Drivers are to be mounted in a well ventilated and accessible location coordinated by the contractor, and approved by the Architect; and, mounted within a NEMA approved UL-ETL listed enclosure(s), to be supplied by the Contractor ONLY if not available from the Manufacturer; Contractor to coordinate.</p> <p>Number of and size of drivers required, [maximum number of fixtures / length of fixture] per driver, length of factory-attached secondary power lead to the fixture (REQUIRED), and when necessary, method of connection to additional secondary cable (to be provided by the Contractor) are to be coordinated by the Contractor with the Fixture Manufacturer. Any connection to additional cable must be made within an approved splice compartment, at an accessible location, approved by the Architect and not in conflict with the fixtures' mounting condition; splice compartment to be supplied by the Contractor ONLY if not available from the Manufacturer; Contractor to coordinate. Additional cable and its wiring method must comply with all local and any other applicable code(s), be 14 gauge minimum (2% maximum voltage drop - target, 5% absolute maximum) unless otherwise approved / required by the Driver Manufacturer, and to not exceed Driver Manufacturer's maximum allowable length (Contractor to coordinate); failure to comply may result in "flicker", and consequently in an unacceptable installation. Electrical Engineer to specify any additional requirements for the cable (ex: plenum rating); Contractor to coordinate.</p>
	Continuous Fixture Runs, connection to power	<p>Continuous fixture runs, in-line power connection - Contractor to coordinate power feed location(s) (and type). Tandem fixture housings must butt with no gaps, or interruptions, assuring continuous light for full length of run.</p>
	Mounting - fixture height	<p>See architect's elevation for mounting height. Contractor to coordinate required stem and/or cable lengths and connections to powers. Mounting height(s) to be verified by Architect (On-site verification may be required, consequently, sufficient advance notice must be provided.)</p>
	LED - Uniform Spacing	<p>LED chip spacing must be uniform for full length of run - Install fixtures with no gaps between tandem mounted housing sections nor across any in-line splices. Contractor to coordinate run configuration (housing lengths and quantities), interconnections between housings, and feed location(s) / orientation. Where possible, multiple power feeds to a single run should be positioned at the (opposite) ends of the run to avoid any connection in-line that would have the potential to interrupt the LED chip spacing.</p>
	Flush Ceiling Trim Installation	<p>Fixtures with a plaster edge and "FLUSH" trim require that the MANUFACTURER'S INSTALLATIONS MUST BE FOLLOWED EXACTLY FOR AN ACCEPTABLE INSTALLATION - Contractor must read and thoroughly understand the manufacture's installation requirements, and procedure PRIOR TO INSTALLATION of the fixture. The bottom edge of the circular plaster ring must be flush with the finished ceiling surface. Housing / trim must be secured to ceiling suspension system with mechanized fasteners (screws), high heat adhesive (RTV), or per manufacturer's directions to provide a "unitized" installation and prevent movement between the housing and ceiling; there should be no cracking at the aperture edge initially, nor over time. Allow sufficient plaster taper (so that there is apparent no bump at the aperture.) AN INCORRECT INSTALLATION WILL RESULT IN AN UNACCEPTABLE CONDITION.</p>

● Indicates items added or revised since last issue

Compact floodlight

Housing: Luminaire constructed of a one piece die-cast aluminum housing. LED module paired with inner reverse-tapered casting to provide maximum heat transfer to outer housing. Die castings are marine grade, copper free ($\leq 0.3\%$ copper content) A360.0 aluminum alloy.

Enclosure: Luminaire's optical system consists of a reflector of pure anodized aluminum and clear safety glass with an integrated stray light control cylinder and a glass optic. The lens and optical assembly is secured by a die cast aluminum trim ring using (3) stainless steel captive fasteners.

Mounting: Provided with a $\frac{1}{2}$ " I.P.S. stainless steel nipple for direct attachment to cast boxes or other accessories.

Electrical: 47.5W LED luminaire, 53 total system watts, -20°C start temperature. Integral 120V through 277V electronic LED driver, 0-10V dimming. LED module(s) are available from factory for easy replacement. Standard LED color temperature is 4000K with a >90 CRI. Available in 3000K (>90 CRI); add suffix K3 to order.

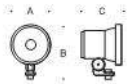
Note: LEDs supplied with luminaire. Due to the dynamic nature of LED technology, LED luminaire data in this catalog is subject to change at the discretion of BEGA-US. For the most current technical data, please refer to www.bega-us.com.

Finish: All BEGA standard finishes are polyester powder coat with minimum 3 mil thickness. These luminaires are available in four standard BEGA colors: Black (BLK); White (WHT); Bronze (BRZ); Silver (SLV). To specify, add appropriate suffix to catalog number. Custom colors supplied on special order.

CSA certified to U.S. and Canadian standards for wet locations. Protection class IP65.

Weight: 6.9 lbs.

Type:
BEGA Product:
Project:
Voltage:
Color:
Options:
Modified:

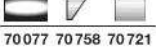


Compact floodlight - very narrow beam

Lamp	β	A	B	C
77651 47.5W LED	10°	9 1/8"	11 5/8"	9"

Exchangeable lenses: flat beam 180° glare shield 360° glare shield

Accessories



70077 70758 70721

β = Beam angle

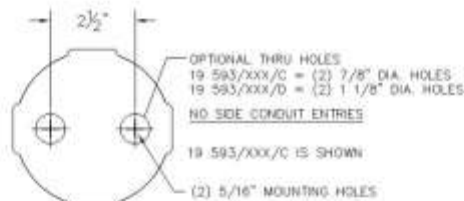
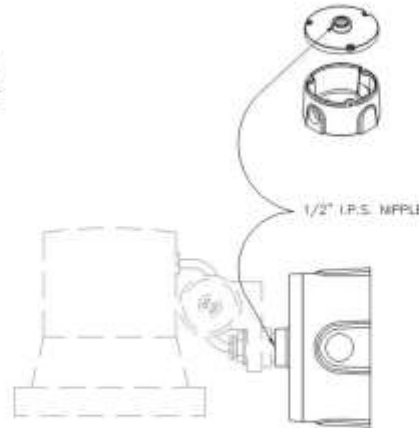
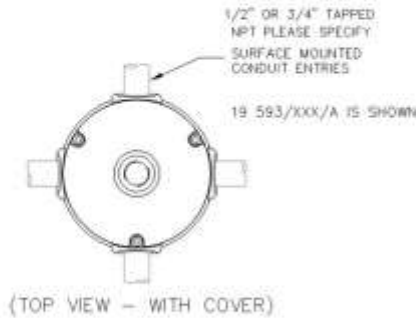


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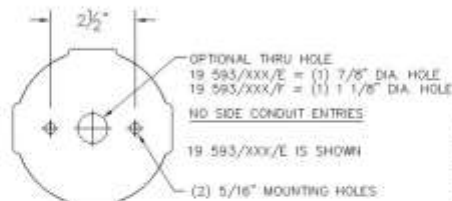
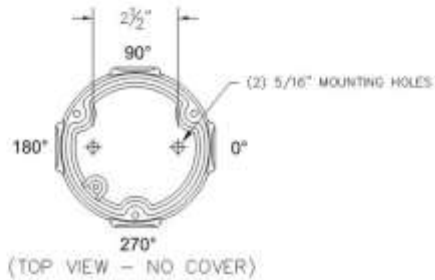
SEE FIXTURE SCHEDULE FOR CATALOG NUMBER AND DESCRIPTION	Type:	TC
	Sheet:	1 of 3

NOTES:

1. BEGA WRING BOX # 19 593/XXX/X:
 - * FOR USE WITH FLOOD LIGHTS WITH 1/2" I.P.S. NIPPLE
 - * TO COMPLETE PART NUMBER:
 - A. START WITH BASE NUMBER - 19 593
 - B. ADD COLOR CODE (BLK, WHT, SLV, BRZ, CUS, RAL)
 - C. FOR SIDE ENTRY ADD SIZE CODE (A, OR B)
 - D. FOR BOTTOM ENTRY ADD SIZE AND QUANTITY CODE
 - 2 ENTRIES (C, OR D), 1 ENTRY (E, OR F)



OPTION C & D
(BOTTOM VIEW)



OPTION E & F
(BOTTOM VIEW)

PART #	CONDUIT ENTRY LOCATION(S)
19593/XXX/A	1/2" NPT @ 0°/90°/180°/270°
19593/XXX/B	3/4" NPT @ 0°/90°/180°/270°
19593/XXX/C	(2) @ 90° ENTRIES (1/2" CONDUIT)
19593/XXX/D	(2) @ 135° ENTRIES (3/4" CONDUIT)
19593/XXX/E	(1) @ 90° ENTRY (1/2" CONDUIT)
19593/XXX/F	(1) @ 135° ENTRY (3/4" CONDUIT)

TYPE: _____

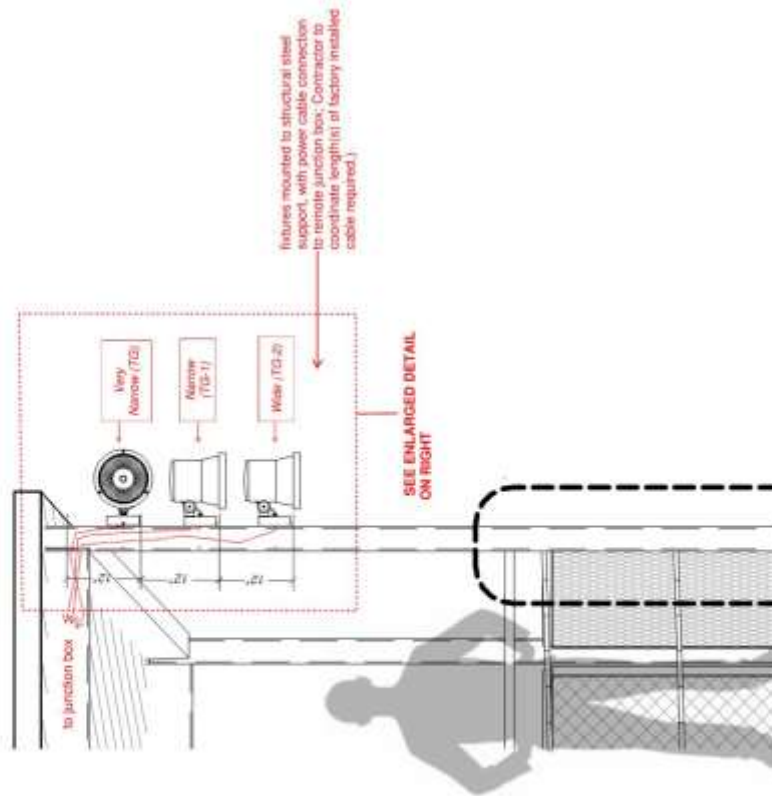
SUBMITTAL APPROVAL APPROVED BY: _____ SIGNED: _____ DATE: _____			CAT NO.: 19 593		BEGA 1000 Bega Way Carpinteria, Ca. 93013 (805) 684-0533
			PROJECT: -		
DRAWING: RA			DATE: 3/28/2018		FILE NAME: 19593.dxf
REV.	DATE	DESCRIPTION	This print contains confidential information which is the property of BEGA U.S. By acceptance this information, the borrower agrees that it will not be used for any other purpose other than that which it was loaned.		

SEE FIXTURE SCHEDULE FOR CATALOG NUMBER AND DESCRIPTION

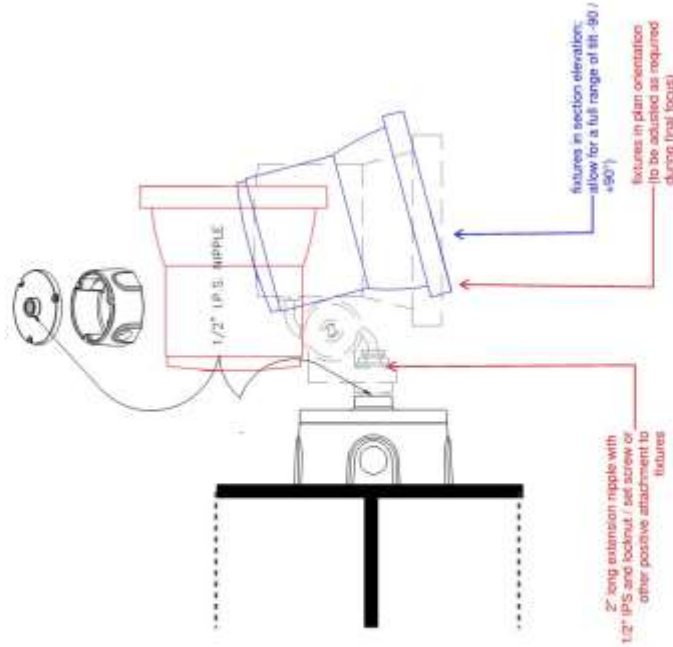
Type: TC
Sheet: 2 of 3

North Waterfront Park

11/26/2019 10:58:07 AM



FRONT ELEVATION



MOUNTING DETAIL

FOLLOWSOT TYPE TC MOUNTING

Scale: N/A

NORTH WATERFRONT PARK
2019.02.20

Compact floodlight

Housing: Luminaire constructed of a one piece die-cast aluminum housing. LED module paired with inner reverse-tapered casting to provide maximum heat transfer to outer housing. Die castings are marine grade, copper free ($\leq 0.3\%$ copper content) A360.0 aluminum alloy.

Enclosure: Optical system consists of a reflector of pure anodized aluminum. The lens and optical assembly are secured by a die cast aluminum trim ring using (3) stainless steel captive fasteners.

Mounting: Provided with a 1/2" I.P.S. stainless steel nipple for direct attachment to cast boxes or other accessories.

Electrical: 48.2W LED luminaire, 51 total system watts, -20°C start temperature, Integral 120V through 277V electronic LED driver, 0-10V dimming. LED module(s) are available from factory for easy replacement. Standard LED color temperature is 4000K with a >90 CRI. Available in 3000K (>90 CRI); add suffix K3 to order.

Note: LEDs supplied with luminaire. Due to the dynamic nature of LED technology, LED luminaire data in this catalog is subject to change at the discretion of BEGA-US. For the most current technical data, please refer to www.bega-us.com.

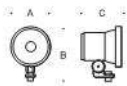
Finish: All BEGA standard finishes are polyester powder coat with minimum 3 mil thickness. These luminaires are available in four standard BEGA colors: Black (BLK); White (WHT); Bronze (BRZ); Silver (SLV). To specify, add appropriate suffix to catalog number. Custom colors supplied on special order.

CSA certified to U.S. and Canadian standards for wet locations. Protection class IP65.

Weight: 5.0 lbs.

Luminaire Lumens: 4236

Type:
BEGA Product:
Project:
Voltage:
Color:
Options:
Modified:



Compact floodlight - narrow beam

Lamp	β	A	B	C
77652 48.2W LED	25°	91/8	11 5/8	9

Exchangeable lenses  flat beam  Louver  180° glare shield β = Beam angle

Accessories

		
70065	70775	70758



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SEE FIXTURE SCHEDULE FOR CATALOG NUMBER AND DESCRIPTION

REVISED

Type:
Sheet:

TC-1
1 of 2

North Waterfront Park

11/26/2019 10:58:07 AM



Concentric ring louver
Designed to tilt lateral pane for floodlights and in-grade luminaires.

Description		A	B	C	D	E
76 775	Concentric ring louver					

SEE FIXTURE SCHEDULE FOR CATALOG NUMBER AND DESCRIPTION

REVISED

Type: TC-1
Sheet: 2 of 2

Compact floodlight

Housing: Luminaire constructed of a one piece die-cast aluminum housing. LED module paired with inner reverse-tapered casting to provide maximum heat transfer to outer housing. Die castings are marine grade, copper free ($\leq 0.3\%$ copper content) A360.0 aluminum alloy.

Enclosure: Optical system consists of a reflector of pure anodized aluminum. The lens and optical assembly are secured by a die cast aluminum trim ring using (3) stainless steel captive fasteners.

Mounting: Provided with a $\frac{1}{2}$ " I.P.S. stainless steel nipple for direct attachment to cast boxes or other accessories.

Electrical: 48.2W LED luminaire, 51 total system watts, -20°C start temperature, Integral 120V through 277V electronic LED driver, 0-10V dimming. LED module(s) are available from factory for easy replacement. Standard LED color temperature is 4000K with a >90 CRI. Available in 3000K (>90 CRI); add suffix K3 to order.

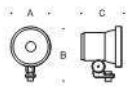
Note: LEDs supplied with luminaire. Due to the dynamic nature of LED technology, LED luminaire data in this catalog is subject to change at the discretion of BEGA-US. For the most current technical data, please refer to www.bega-us.com.



Finish: All BEGA standard finishes are polyester powder coat with minimum 3 mil thickness. These luminaires are available in four standard BEGA colors: Black (BLK); White (WHT); Bronze (BRZ); Silver (SLV). To specify, add appropriate suffix to catalog number. Custom colors supplied on special order.

CSA certified to U.S. and Canadian standards for wet locations. Protection class IP65.

Weight: 5.0 lbs.

Type:
BEGA Product:
Project:
Voltage:
Color:
Options:
Modified:



Compact floodlight - wide beam					Accessories	
Lamp	β	A	B	C		
77653 48.2W LED	50°	9 1/8"	11 5/8"	9"	70065	70758
Exchangeable lenses	 flat beam	 180° glare shield	β = Beam angle			



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Type:
Sheet:

TC-2
1 of 2

North Waterfront Park

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Concentric ring louver
Designed to link lateral glare for floodlights and in-grade luminaires.

Description		A	B	C	D	E
76 775	Concentric ring louver					

SEE FIXTURE SCHEDULE FOR CATALOG NUMBER AND DESCRIPTION

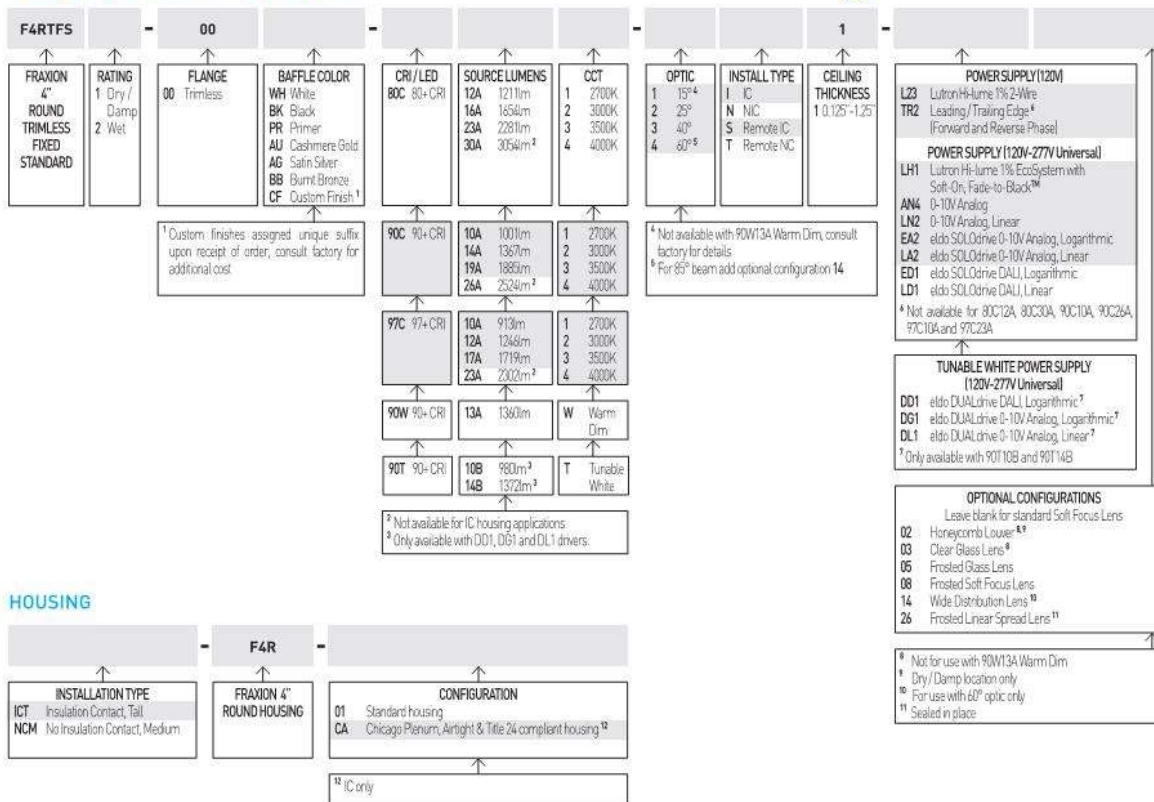
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Type: TC-2
Sheet: 2 of 2

PERFORMANCE

80+ CRI [40° Optic]				90+ CRI [40° Optic]				97+ CRI [40° Optic]				WARM DIM 90+ CRI [40° Optic]				
LED Configuration	Delivered Lumens lm	Power Consumption W	Luminous Efficacy lm/W	LED Configuration	Delivered Lumens lm	Power Consumption W	Luminous Efficacy lm/W	LED Configuration	Delivered Lumens lm	Power Consumption W	Luminous Efficacy lm/W	LED Configuration	Delivered Lumens lm	Power Consumption W	Luminous Efficacy lm/W	
80C12A	872	10	86	90C10A	721	10	71	97C10A	657	10	65	TUNABLE WHITE 90+ CRI [40° Optic]	90W13A	836	14	59
80C16A	1191	14	82	90C14A	984	14	68	97C12A	897	14	62		90T10B	673	14	49
80C23A	1642	21	77	90C19A	1357	21	63	97C17A	1238	21	58		90T14B	918	18	51
80C30A	2199	31	70	90C26A	1817	31	58	97C23A	1657	31	53					

JA8-2016 INDICATED BY SHADING



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pg. 1

FRAXION⁴® F4RTFS TRIMLESS

ACCESSORIES

REPLACEMENT BAFFLE ASSEMBLY (INCLUDES EFFECTS DEVICE)



REPLACEMENT OPTICS

Interchangeable optics accessible through fixture aperture.

- ☐ RO-70-15-1 15° optic ⁴
- ☐ RO-70-25-1 25° optic
- ☐ RO-70-40-1 40° optic
- ☐ RO-70-60-1 60° optic

⁴ Not for use with 90W13A Warm Dim
 Dim, consult factory for details

TUNABLE WHITE

REPLACEMENT OPTICS

Interchangeable optics accessible through fixture aperture.

- ☐ RO-70-15-2 15° optic
- ☐ RO-70-25-2 25° optic
- ☐ RO-70-40-2 40° optic
- ☐ RO-70-60-2 60° optic

REPLACEMENT SUCTION TOOL

One included with every six fixtures designated with frosted linear spread lens or Wet location.

- ☐ F4-TOOL-SUCTION Allows removal of baffle with frosted linear spread lens or Wet location

EMERGENCY LIGHTING - REMOTE MOUNT ONLY

- ☐ EMB-S-20/25-120/277-LEDX 20/25 watt max capacity, 120 or 277 VAC 60Hz
- ☐ EMB-S-100-120-LEDX 100 watt max capacity, 120 VAC 60Hz
- ☐ EMB-S-100-277-LEDX 100 watt max capacity, 277 VAC 60Hz
- ☐ EMB-S-250-120/277-LEDX 250 watt max capacity, 120 or 277 VAC 60Hz

During disruption of main power, emergency battery inverter provides temporary 120V or 277V to fixture.

TECHNICAL

CONSTRUCTION

Downlight: Aluminum and steel. Extruded aluminum heat-sink. Painted finishes are granulated powder coat.

Housing: 22 Gauge galvanized steel.

Remote Power Supply: 22 Gauge galvanized steel.

Applique: Zinc Alloy

LED

Proprietary Citizen 2 step MacAdam ellipse LED module available in 80+, 90+ and 97+ CRI configurations in color temperatures of 2700K, 3000K, 3500K and 4000K. Average rated lamp life: 50,000 hours. LED and driver assemblies are field-replaceable.

WARM DIM LED

Proprietary 3 step MacAdam ellipse warm dim LED module available in 90+ CRI configuration. 3200K at full brightness, warming to 1800K at full dim. Average rated lamp life of 50,000 hours. LED and driver assemblies are field-replaceable.

TUNABLE WHITE LED

Proprietary 5 step MacAdam ellipse tunable white LED module available in 90+ CRI configuration. Features tuning range of 2700K to 5000K. Average rated lamp life: 50,000 hours. LED and driver assemblies are field-replaceable.

POWER SUPPLY PERFORMANCE AND DIMMING INFORMATION

	ELV		ECO		0-10V						DALI		
Power Supply	TR2	L23	LH1	ANA	LN2	EA2	LA2	DL1	DG1	ED1	LD1	DD1	
Minimum °C	-20 °C	0 °C	0 °C	-20 °C	-20 °C	-20 °C	-20 °C	-20 °C	-20 °C	-20 °C	-20 °C	-20 °C	
Maximum °C	40 °C	40 °C	40 °C	40 °C	40 °C	40 °C	40 °C	40 °C	40 °C	40 °C	40 °C	40 °C	
Dimming %	2.0%	1.0%	1.0%	1.0%	1.0%	0.1%	0.1%	0.1%	0.1%	0.1%	0.1%	0.0%	

Note: For EA2, LA2 and L23 drivers consult chart on page 4 to confirm appropriate dimming curve for compatibility with selected control.

LISTING

cTUVus listed to UL1598 standard for Dry / Damp and Wet locations. Chicago Plenum, Airtight and Title 24 JA8-2016 Listed. Patent pending.

WARRANTY

Manufacturer's 1-year warranty guarantees product(s) listed to be free from defects in material and workmanship under normal use and service. 5-year warranty on LED and power supply to operate with 70% of the original flux and remain within a range of 3 duv. 10-year Lutron Advantage limited warranty available on Lutron equipped systems. Warranty period begins from the date of shipment by Seller and conditional upon the use of manufacturer-supplied power supply. Consult website for full warranty terms and conditions.



TITLE 24 JA8-2016 COMPLIANT CONFIGURATIONS

Lumen Package	90C10A	90C14A	90C19A	97C10A	97C12A	97C17A
15° Optic	✓	✓	✓	✓	✓	✓
25° Optic	✓	✓	✓	✓	✓	✓
40° Optic	✓	✓	✓	✓	✓	✓
60° Optic	✓	✓	✓	✓	✓	✓
85° Beam	✓	✓	✓	✓	✓	✓

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pg. 2

SEE FIXTURE SCHEDULE FOR CATALOG NUMBER AND DESCRIPTION

Type: TG
 Sheet: 2 of 4

North Waterfront Park

11/26/2019 10:58:07 AM

FRAXION⁴® F4RTFS TRIMLESS

DOWNLIGHT

A BAFFLE

Die-cast baffle minimizes aperture glare and conceals view into housing; includes silicone gasket.

B RETENTION

Integrated metal arm clamps located within fixture body allow discreet flange design, while accommodating varying ceiling thicknesses from 0.50" (13mm) to 1.25" (32mm).

C OPTIC

Proprietary field-changeable optic integrates Reflection, Refraction and TIR offering 15°, 25°, 40° & 60° beams.

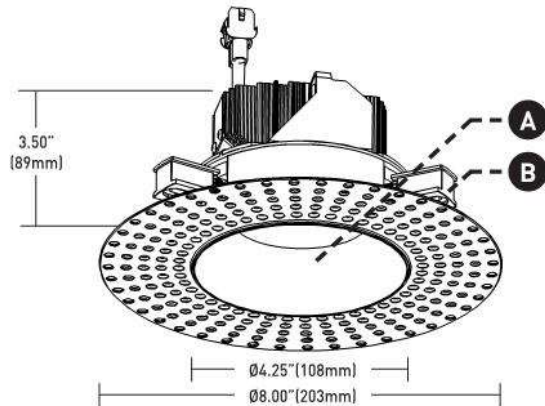
D EFFECTS DEVICES

Soft focus lens included and sealed in Wet location option. Fixture is limited to 1 lens. Suction tool provided for removal of baffle with linear spread lens or Wet location.

E TRIMLESS PROFILE

Installs totally flush with the ceiling with no visible trim. Features integrated appliqué for plaster floating directly to the baffle. Not recommended for stucco applications.

DIMENSIONS / DRAWINGS



HOUSING / MOUNTING

F ICT (IC) HOUSING - TALL

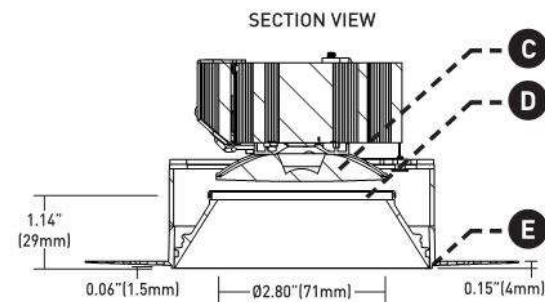
- For IC ceilings.
- Chicago Plenum, Airtight and Title 24 (JA8) listed.
- Accommodates max 1642 delivered lumens.
- No setback from polycell spray foam insulation having max R-Value of 60 on all sides and top of housing.

G NCM (NIC) HOUSING - MEDIUM

- Minimum 0.50" (13mm) setback from combustible and non-combustible materials on all sides and top of housing.
- Minimum 3.00" (76mm) setback from insulation material having max R-Value 30 on all sides and top of housing.
- Minimum 6.00" (152mm) setback from polycell spray foam insulation having max R-Value 60.

H HOUSING COLLAR

- Requires 4.625" (117mm) diameter cutout.
- Fixed round aperture housing collar.
- Accommodates varying ceiling thicknesses.

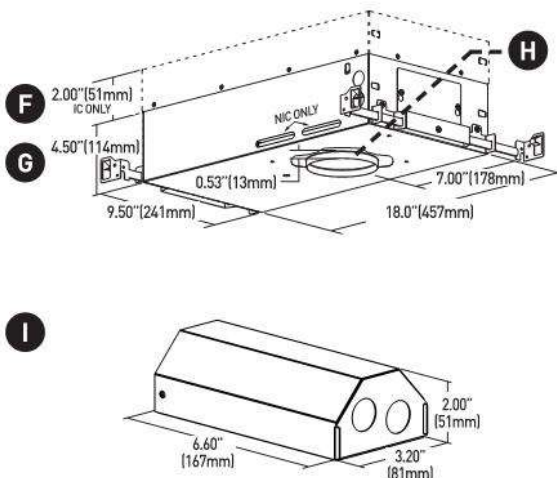


HOUSING / MOUNTING NOTES

- Do not install in environments where ambient temperatures exceed 40°C (104°F).
- Power supply compartment and all splice connections may be serviced from room side.
- Consult factory for spacing requirements for any installations exceeding R-Value 60.
- Hanger bars fitted to short side of housing, extend from 14.0" to 24.0", but may be field cut to accommodate narrow stud spacing.
- Hanger bars and brackets add 4.00" to the overall dimension, but are exclusive of the setback requirements.
- Driver assembly ships with trim, not housing. Housing and trim feature mating quick-connect plugs for ease of installation.

REMOTE POWER SUPPLY

- Provided with install types "S" and "T".



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pg. 3

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Type: TG
Sheet: 3 of 4

North Waterfront Park

11/26/2019 10:58:07 AM

FRAXION4® F4RTFS TRIMLESS

DIMMING COMPATIBILITY

eldoLED DRIVER COMPATIBILITY

Power supply EA2, LA2 Dimmer / Switch Control Manufacturer	Family/Model #	Recommended Curve
Busch-Jaeger	2112U-101	Logarithmic
Jung	240-10	Logarithmic
Leviton Lighting Controls	IP710-DLX	Logarithmic
Lightolier Controls	ZP600FAM120	Logarithmic
Lutron Electronics	Nova T® - NTFTV	Linear
Lutron Electronics	Diva® - DDTV	Linear
Lutron Electronics	Nova® - NDTV	Linear
Merten	5729	Logarithmic
Pass & Seymour	CD4FB-W	Logarithmic
The Watt Stopper	DCLV1	Logarithmic
Sensor Switch	nIO EZ	Linear
Synergy	ISD BC	Logarithmic
Lighting Control Systems		
Lutron Electronics	GrafixEye® GRX-TVI w GRX3503	Linear
Lutron Electronics	Energy Savr Node™ - QSN-4T16-S	Linear
Lutron Electronics	TVM2 Module	Linear
Creston®	GLX-DIMFLV8	Logarithmic
Creston®	GLXP-DIMFLV8	Logarithmic
Creston®	GLPAC-DIMFLV4-*	Logarithmic
Creston®	GLPAC-DIMFLV8-*	Logarithmic
Creston®	GLPP-DIMFLVEX-PM	Logarithmic
Creston®	GLPP-1DIMFLV2EX-PM	Logarithmic
Creston®	GLPP-1DIMFLV3EX-PM	Logarithmic
Creston®	DIN-A08	Logarithmic
Creston®	DIN-4DIMFLV4	Logarithmic
Creston®	CLS-EXP-DIMFLV	Logarithmic
Creston®	CLCI-1DIMFLV2EX	Logarithmic
ABB	SD/S 2.16.1	Logarithmic

LUTRON DRIVER COMPATIBILITY

Power supply L23 Product Family	Part No.	Fixtures Per Control (120V only)
Maestro WirelessR 600 W dimmer	MRF2-6ND-120-	1-8
Maestro WirelessR 1000 W dimmer	MRF2-10ND-120-	1-13
Caséta® Wireless Pro 1000 W dimmer	PD-10NXD-	1-13
GRAFIK T™ CL® dimmer	GT-250M-, GTJ-250M-	1-10
HomeWorks® QS adaptive dimmer	HQRD-6NA-	1-8
HomeWorks® QS 600 W dimmer	HQRD-6ND-	1-8
HomeWorks® QS 1000 W dimmer	HQRD-10ND-	1-13
RadioRA® 2 adaptive dimmer	RRD-6NA-	1-8
RadioRA® 2 1000 W dimmer	RRD-10ND-	1-13
myRoom™ DIN power module	MQSE-4A1-D	1-6 (per output), 1A max driver input current
HomeWorks® QS DIN power module	LQSE-4A1-D	1-6 (per output), 1A max driver input current
HomeWorks® QS wallbox power module	HQRJ-WPM-6D-120	2-10 (per output), 26 total per module
HomeWorks® wallbox power module	HWI-WPM-6D-120	2-10 (per output), 26 total per module
GRAFIK Eye® QS control unit	QSGR-, QSGRJ-	2-10 (per output), 26 total per module
GRAFIK Eye® 3000 control unit	GRX-3100-, GRX-3500-	2-10 (per output), 26 total per module
RPM-4U module (LCP, HomeWorks® QS, GRAFIK Systems™, Quantum®)	HW-RPM-4U-120, LP-RPM-4U-120	2-26 (per output), 26 total per module
RPM-4A module (LCP, HomeWorks® QS, GRAFIK Systems™, Quantum®)	HW-RPM-4A-120, LP-RPM-4A-120	1-13 (per output), 26 total per module
GP dimming panels	Various	1-26
Ariadni CL 250W dimmer	AYCL-253P-	1-8
Diva CL 250W dimmer	DVCL-253P-DCSCCL-253P-	1-8
Nova T CL 250W dimmer	NTCL-250-	1-10



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pg. 4

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Type: TG
Sheet: 4 of 4

North Waterfront Park

11/26/2019 10:58:07 AM

Grüv® 4" High Efficiency Recessed Linear LED



Grüv 4" Recessed Linear

Features

Designed to provide high-performance, visually comfortable, high efficient ambient lighting with a 4" aperture for commercial and office environments. Featuring improved extruded aluminum and steel construction, superb aesthetics, lower costs and shorter lead times, Grüv 4" HE is more effective and aesthetically appealing than many recessed linear fixtures available today.

Product Overview

Type:	Recessed Lens Direct
Wattage:	5W/ft, 10W/ft (other wattages available see p2)
Lumen Output:	3,794 max; 100.1 Lm/W (10W, 4ft fixture)
Color Temp:	2700K, 3000K, 3500K, 4000K
CRI:	83 typ. (2700K, 3000K, 3500K, 4000K)
Dimming:	0-10V, 1% dimming (standard) Lutron Hi-lume® 2 wire (120V only) Lutron Hi-lume® EcoSystem, 1% dim, fade to off Lutron Hi-lume® 5 Series DALI dimming, 0.1% dim

PROJECT:

TYPE:

Fixture Summary *(see following pages for more information)*

Ceiling Types

4" Tech Zone	6" Tech Zone	9/16"	15/16"	Gyp Board	Millwork
Yes	No	Yes	CF*	Yes	Yes

Perimeter J-Mold
Yes

*Consult factory (tees are 4 3/4" on center)

Performance Chart

Wattage Per Foot	Delivered Lumens	LPW	Color Temp
5	2,148	107.0	3500K
10	3,794	100.1	3500K

Data is based on 3500K-83 IES files available on website
Data is based on 4' fixture with performance lens

Electrical Data

Wattage Per Foot		4'		8'	
		System Watts	Amps	System Watts	Amps
5	120V	22.3	0.18	41.9	0.35
	277V	22.9	0.09	41.8	0.16
10	120V	42.1	0.30	84.2	0.70
	277V	41.5	0.15	83.0	0.30

Electronic multi-volt (120V-277V), constant current LED driver

Standard Patterns

"L"	"J"	"U"	"O"	"Z"	Wall to Ceiling	Custom*
Yes	Yes	Yes	Yes	Yes	Yes	Yes

* Submit drawing, consult factory

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SEE FIXTURE SCHEDULE FOR CATALOG NUMBER AND DESCRIPTION

Type: TH
Sheet: 1 of 7

North Waterfront Park

11/26/2019 10:58:07 AM

Grüv® 4" High Efficiency

Recessed Linear LED



Grüv 4" Recessed Linear

PROJECT:

TYPE:

Ordering Information

1

2

3

4

5

6

7

8

9

10

1

Model

GRUV4-HE-FLG-A16+ - exposed flanged
GRUV4-HE-FLG-GRID-A16+ - flanged, grid mount
GRUV4-HE-GB-A16+ - gyp board trimless, mud-in
GRUV4-HE-GRID-A16+ - grid mount
GRUV4-HE-IS-A16+ - independently suspended
GRUV4-HE-J/GB-A16+ - j-mold/gyp board trimless
GRUV4-HE-J/GRID-A16+ - j-mold/grid
GRUV4-HE-J/IS-A16+ - j-mold/independently suspended

2

Optics

PL - performance lens (standard)
DL - designer lens

3

Wattage (per foot)

Standard:
5 - 5W/ft
10 - 10W/ft
Optional:
3 - 3W/ft (4' minimum length required)
4 - 4W/ft (4' minimum length required)
6 - 6W/ft
7 - 7W/ft
8 - 8W/ft
9 - 9W/ft

4

Color Temp

83 CRI:
27 - 2700K-83
30 - 3000K-83
35 - 3500K-83
40 - 4000K-83
92 CRI optional, consult factory

5

Finish

HW - high reflectance white

6

Voltage

120/277

7

Length

(Length A)	(Length B)	(Length C)
Length A (used for)	Length B (used for)	Length C (used for)
- all patterns	- all patterns	- PU
- IND/IND-S+	- PR - 2 lengths of 2	- PZ
- CON/CON-S+		
- CUS		

8

Configuration

IND+ - individual fixture, 2' to 8' in 1' increments
IND-S+ - individual with standard plus (see pg7, not for Flanged versions)
CON - continuous run > than 8', specify to nearest foot
CON-S+ - continuous run with standard plus (see pg7, not for Flanged versions)
CUS - custom made to measure, +/- 1/8" of customer supplied field dimensions
Standard Patterns (see page 8 for details):
PLL - L left, (2) straights + (1) 90° corner, leg right
PLR - L right, (2) straights + (1) 90° corner, leg left
PU - U shape, (3) straight lengths + (2) 90° corners
PR - Rectangle, (4) straight lengths + (4) 90° corners
PZ - Z shape, (3) straight lengths + (2) 90° corners
PWC - wall to ceiling (1) 90° Corner joining 2 segments
Custom Patterns:
PC - please provide drawings and consult factory

9

Drivers

0-10V - 1% electronic dimming, multi-volt (120V-277V) constant current driver (standard).
HILUME-A-LTE - Lutron "A" Series, 1% dim, 2-wire, 120V only
HILUME-H-ECO - Lutron "H" Series, 1% dim, fade to off, EcoSystem
HILUME-S-ECO - Lutron "S" Series, EcoSystem
DALI - DALI Dimming 120 / 277v, 0.1% dim

10

Options/Accessories

CP - Chicago Plenum (CCEA)
ENLS - Enlighted Sensor (0-10V only and not available on 2' & 3' lengths)
WHIP - 6' whip, 18/5 conductor
EMC-PF² - emergency circuit requires power feed located in last fixture section (for other locations consult factory)
PF² - Extra power feed for additional circuiting

1 - Lengths less than 4' may have restrictions based upon wattage, lengths, drivers or other options.

2 - Not available with IND (individual) configuration.

* The "A" refers to the sequential revision in a year and "XX" refers to the year of update. Updates coincide with improved performance while not changing the overall fixture aesthetic and are reflected in the published performance data. Please contact your Amerlux representative for explanations of changes.

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SEE FIXTURE SCHEDULE FOR CATALOG NUMBER AND DESCRIPTION

Type: TH
 Sheet: 2 of 7

North Waterfront Park

11/26/2019 10:58:07 AM

Grüv® 4" High Efficiency

Recessed Linear LED



Grüv 4" Recessed Linear

PROJECT:

TYPE:

Specifications

Application

Commercial and retail recessed ambient lighting can be customized with made to measure lengths, patterns, ceilings or wall mounted fixtures.

Construction

Heavy gauge steel upper housing is secured to aluminum extruded trim rails. Die-formed, cold-rolled steel internal components and external mounting brackets. Numerous configurations accommodate most architectural ceiling conditions.

Optical

All lenses are snap-in, extruded acrylic, with a maximum length of 8'. Amerlux's proprietary acrylic lens provide excellent transmission while effectively concealing source image.

PL - Performance Lens provides high efficiency with controlled lens surface brightness (standard).

DL - Designer Lens provides flat even glow on lens. Best when lens is in direct or constant view. Such as vertical wall mounted.

LED

Amerlux's boards and patented connector design with brand name LEDs enables Amerlux fixtures to have excellent thermal management and offer a 5 year warranty. Our LED binning is within 3 MacAdam ellipse. Boards are configured for maximum flexibility resulting in even illumination no matter the fixture layout. LED boards are easily replaced in the field with just a Phillips screw driver.

Color Temperature Options:

2700K, 3000K, 3500K, 4000K

CRI: 83 typical, 92 optional - consult factory

R9: 16 @ CRI 83

R9: >50 @ CRI 92

Life: 50,000+ hr., > 70% of initial lumens (L70)

Electrical

Wiring: Supply wires are easily accessible through access plate on top of fixture.

WHIP: Optional factory installed 6' Greenfield whip (18/5 conductor) simplifies installation.

Standard Wattage: 5W/ft, 10W/ft.

Optional Wattages: 3W/ft, 4W/ft, 6W/ft, 7W/ft, 8W/ft, 9W/ft. (3W & 4W have a minimum length of 4'). For other wattages consult factory. Emergency circuit via remote inverter or auxiliary emergency power supply (by others).

This product complies with IEEE C62.41 for surge endurance up to 2.5KV. Amerlux® recommends using additional surge protection with this unit (supplied by others), surge and over voltage damage is not covered under warranty.

EMC-PF - Emergency circuit requires power feed to be located in last fixture section for continuous runs. For other locations consult factory. Not available for individual (IND) configuration.

PF - Extra power feed for additional circuiting. Not available for individual (IND) configuration.

Drivers

0-10V - 1% electronic dimming, multi-volt (120V-277V) constant current driver (standard). Cap leads for non-dim applications.

Optional Drivers:

HILUME-A-LTE - Lutron "A" Series, 1% dim, 2-wire, 120V only

HILUME-H-ECO - Lutron "H" Series, 1% dim, fade to off, EcoSystem

HILUME-S-ECO - Lutron "S" Series, EcoSystem

DALI - DALI Dimming 120V-277V, 0.1% dim

Finish

HW - High reflectance, matte white powder coat paint. Baked on finish for maximum durability and color stability.

Configurations/Lengths

IND - Individual fixtures are made of single standard lengths of 2 ft to 8 ft (in 1' increments). These are stand alone fixtures with matching End Caps, supplied with the mounting hardware. Lengths less than 4' may have restrictions based upon wattage, lengths, drivers or other options.

CON - Continuous runs, > 8', specified to nearest whole foot length in 1' increments. Runs made from standard lengths have End Caps at the beginning and end of run. Runs > 60' may require second power feed. Each Housing has factory installed alignment pins. Mating fixtures are easily aligned and joined with "catch and latch" mechanisms out of sight, on top of the Housing. Wiring is made fast and positive with molded quick connectors.

S+ - Standard Plus is a field cuttable filler bracket that can be used when an individual fixture or a Continuous run isn't to the nearest foot (+3/4" to 6" max per end). See page 7 for details.

CUS - Custom made to measure runs are made to nearest 1/8" of customer supplied field measurements or drawings. Custom lengths use the same hardware for hairline joining.

PXX - Standard Patterns consist of 90° corners with standard lengths (4' to 8' in 1' increments), continuous runs or made to measure lengths. Depending upon complexity of the pattern drawings may be required from the Customer. If ordering please give overall lengths.

A'-B'-PLL - L Left - (1) 90° Corner 2 segments. Specify overall segments: A' & B'

A'-B'-PLR - L Right - (1) 90° Corner 2 segments. Specify overall segments: A' & B'

A'-B'-PR - Rectangle - (4) 90° Corners joining 4 segments. Specify overall segments: A' & B'

A'-B'-C'-PU - U shape - (2) 90° Corners joining 3 segments. Specify overall segments: A', B', & C'

A'-B'-C'-PZ - Z shape - (2) 90° Corners joining 3 segments. Specify overall segments: A', B', & C'

A'-B'-PWC - Wall to Ceiling - 90° joining bracket. Specify overall segments: A' & B'

See page 8 for layouts.

PC - Custom Patterns may use standard lengths. Made To Measure, 90° or other corners (some limitations). Please provide drawing and consult factory.

Please note: Corners have lit mitered Lens.

Mounting

Intended for use in gypsum board, 9/16" Tee grid and Screw Slot, and millwork ceilings. Wall mounting J-Molding details available. For individual, continuous row, or pattern applications.

Please note - fixtures to be installed before gypsum board ceiling.

GRUV4-HE-FLG-A16 - exposed flange, fixture into gypsum board ceiling

GRUV4-FLG-GRID-A16 - exposed flange grid mount, fixture in 9/16" Flat Tee ceilings. Consult factory for 15/16" ceilings.

GRUV4-HE-GB-A16 - gyp trimless mud, fixture plastered in gypsum board ceiling

GRUV4-HE-GRID-A16 - grid mount, in 9/16" Screw Slot or Flat Tee ceilings (compatible with 4" TechZone™ & other 4" wide architectural ceiling systems)

GRUV4-HE-IS-A16 - independently suspended, fixture in wood ceiling

GRUV4-HE-J/GB-A16 - J mold/gyp trimless, plastered in ceiling - J Channel wall side

GRUV4-HE-J/GRID-A16 - J mold/grid, in 9/16" Screw Slot or Flat Tee ceilings - J Channel wall side

GRUV4-HE-J-IS-A16 - J mold/independently suspended in ceiling - J Channel wall side.

Certifications

Approved to UL standards for damp locations as tested by CSA

Intended for indoor use only

Chicago Plenum (CCEA) optional

Warranty

Amerlux's 5 year limited warranty. Please consult Amerlux website for details.

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SEE FIXTURE SCHEDULE FOR CATALOG NUMBER AND DESCRIPTION

Type: TH
Sheet: 3 of 7

North Waterfront Park

11/26/2019 10:58:07 AM

Grüv® 4" High Efficiency

Recessed Linear LED

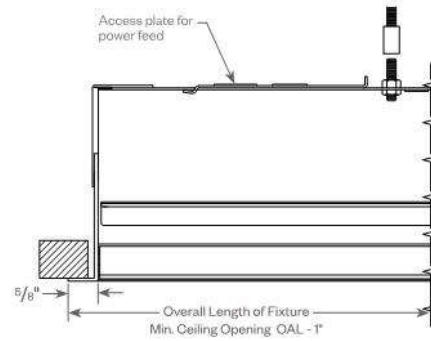
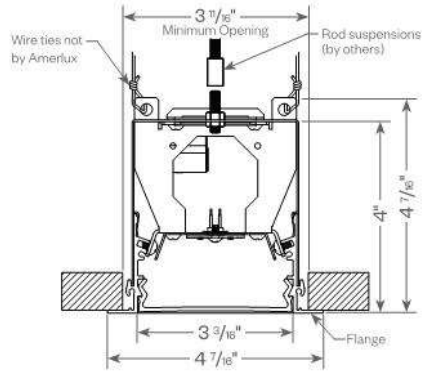


Grüv 4" Recessed Linear

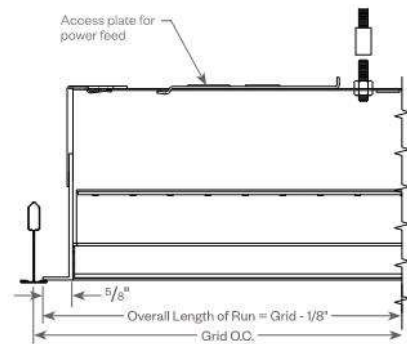
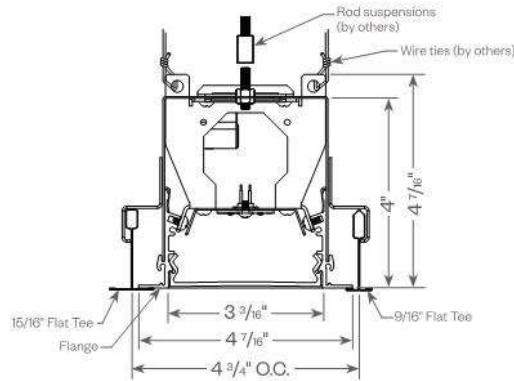
PROJECT:

TYPE:

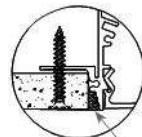
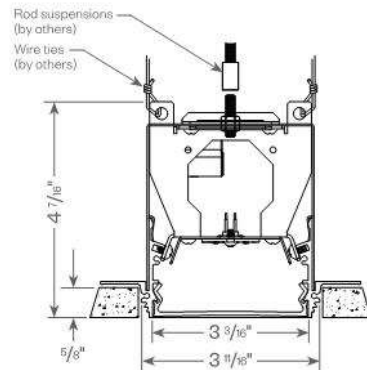
GRUV4-HE-FLG (exposed flange)



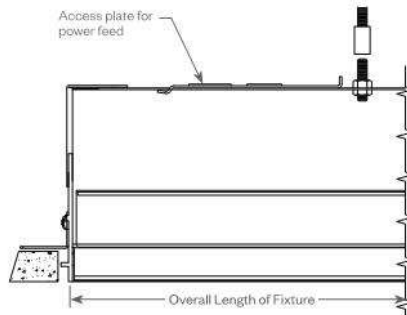
GRUV4-HE-FLG-GRID (flanged, grid mount)



GRUV4-HE-GB (gyp board trimless mud-in) Compatible (see pg 7)



Ceiling contractor to spackle, feather and sand at ceiling interface.



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Type: TH
Sheet: 4 of 7

North Waterfront Park

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Grüv® 4" High Efficiency

Recessed Linear LED



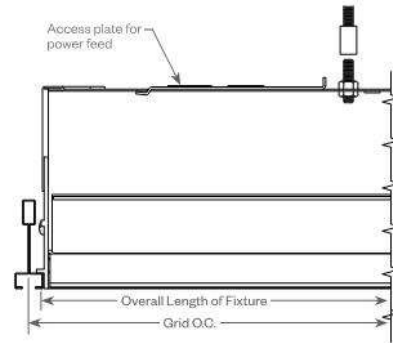
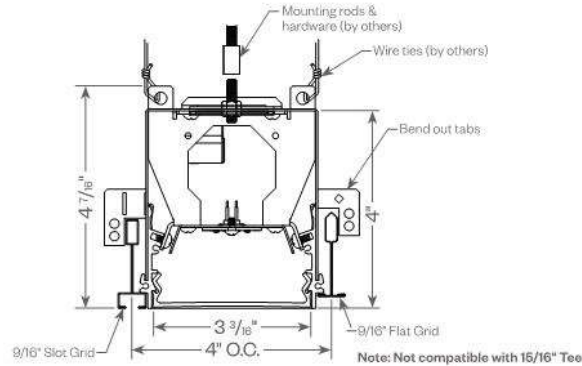
Grüv 4" Recessed Linear

PROJECT:

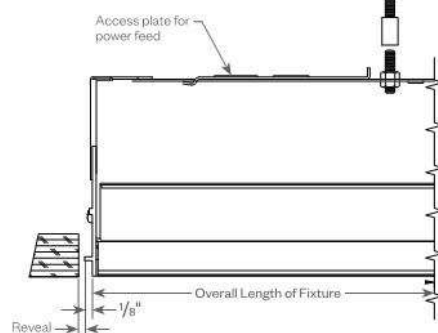
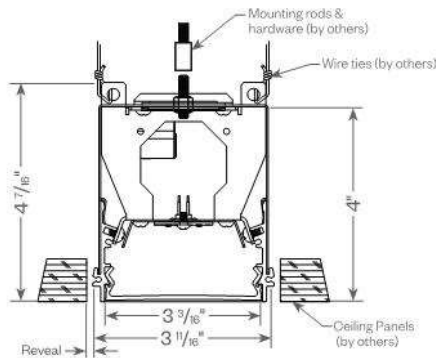
TYPE:

GRÜV4-HE-GRID (grid mount) Compatible (see pg 7)

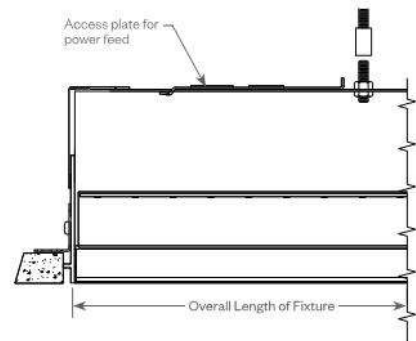
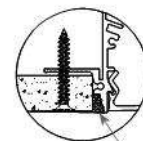
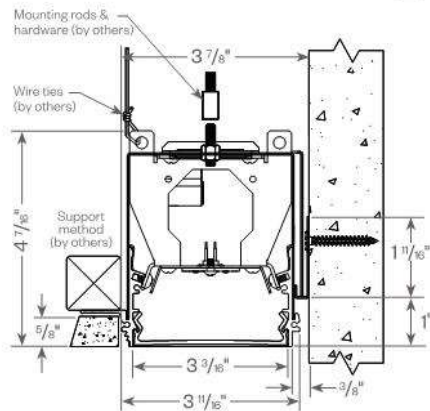
4" TechZone compatible



GRÜV4-HE-IS (independently suspended) Compatible (see pg 7)



GRÜV4-HE-J/GB (j-mold/gyp board trimless) Compatible (see pg 7)



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Type: TH
Sheet: 5 of 7

North Waterfront Park

11/26/2019 10:58:07 AM

Grüv® 4" High Efficiency

Recessed Linear LED

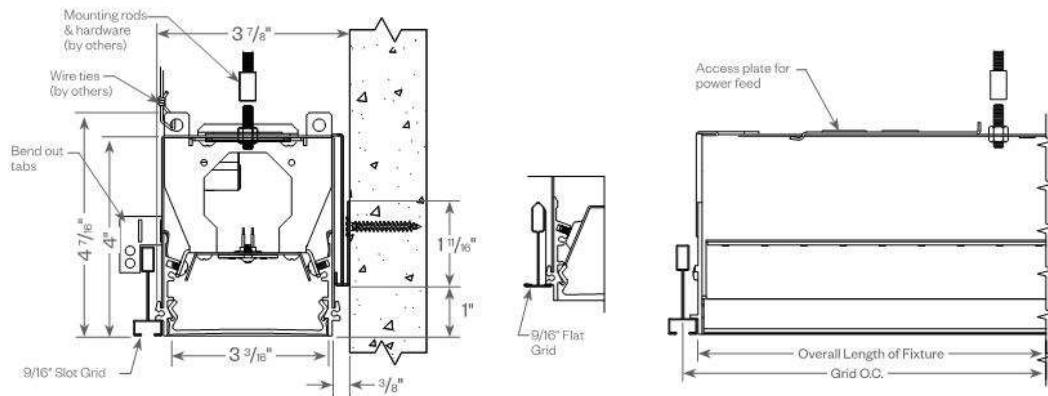


Grüv 4" Recessed Linear

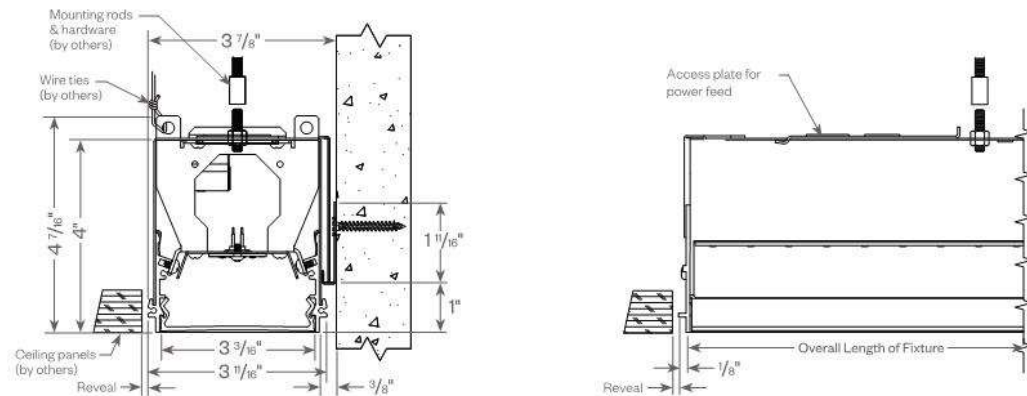
PROJECT:

TYPE:

GRÜV4-HE-J/GRID (j-mold/grid mount) Compatible (see pg 7)



GRÜV4-HE-J/IS (j-mold/independently suspended) Compatible (see pg 7)



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Type: TH
Sheet: 6 of 7

North Waterfront Park

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Grüv® 4" High Efficiency

Recessed Linear LED



Grüv 4" Recessed Linear

PROJECT:

TYPE:

STANDARD PLUS

STANDARD PLUS (FILLER):

Whenever a continuous run is less than a foot to the next full foot length consider ordering Standard Plus field cuttable bracket for a perfect look. Fits gypsum board, 9/16" Slot Grid and 9/16" T grid. It snaps in place easily from below and gets you close to the wall with a standard fixture. Saves time and money compared to made-to-measure.



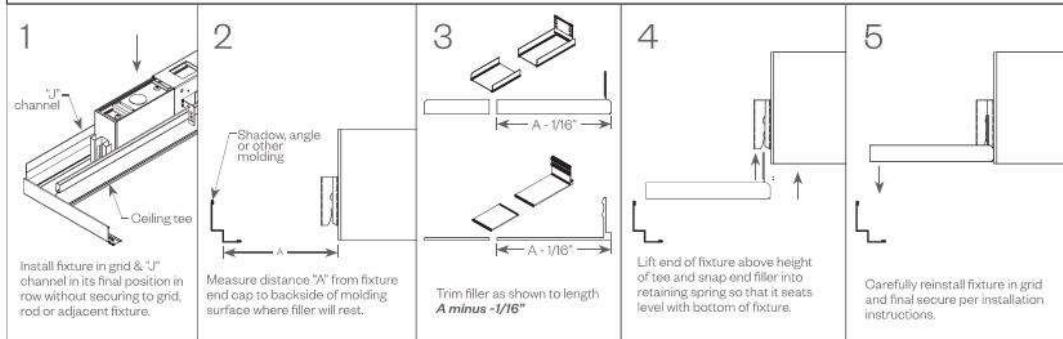
GRID VERSION



GYP VERSION

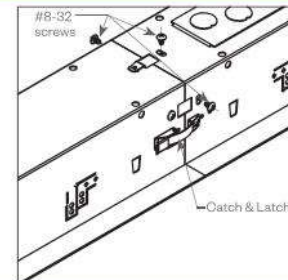
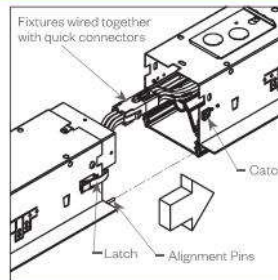
NOTE: Use with Gruv4-HE-GB, Gruv4-HE-Grid, Gruv4-HE-IS, Gruv4-HE-J/GB, Gruv4-HE-J/Grid and Gruv4-HE-J/IS

FILLER TRIM AND INSTALLATION (GRUV 1.5 GRID SHOWN HERE)



TOOLLESS JOINING

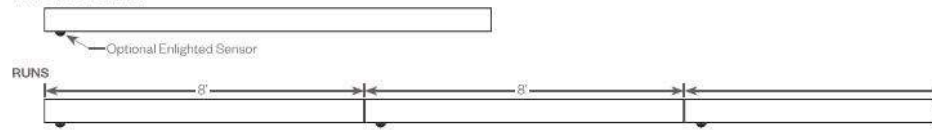
Line up the two housings by using the alignment pins. Secure them together by using the Catch & Latch System on the side of the extrusion.



OPTIONAL ENLIGHTED SENSOR:

Amerlux® and Enlighted have partnered to create building environments that are safer, and smarter, than ever before. At the heart of our partnership is Enlighted's Smart Sensor, the most advanced digital sensor available today. Integrated into Amerlux products, the sensor seamlessly collects and communicates dense data on building security, occupancy, performance, environmental conditions, ambient light levels, temperature, and energy consumption. This intelligence provides building managers with unprecedented guidance on cost savings and site-planning efficiencies. Enlighted Sensor (ENLS) is available with 0-10V driver only. Minimum run length is 4'. Enlighted power pack is provided with ENLS option.

4 FT OR 8 FT DIRECT



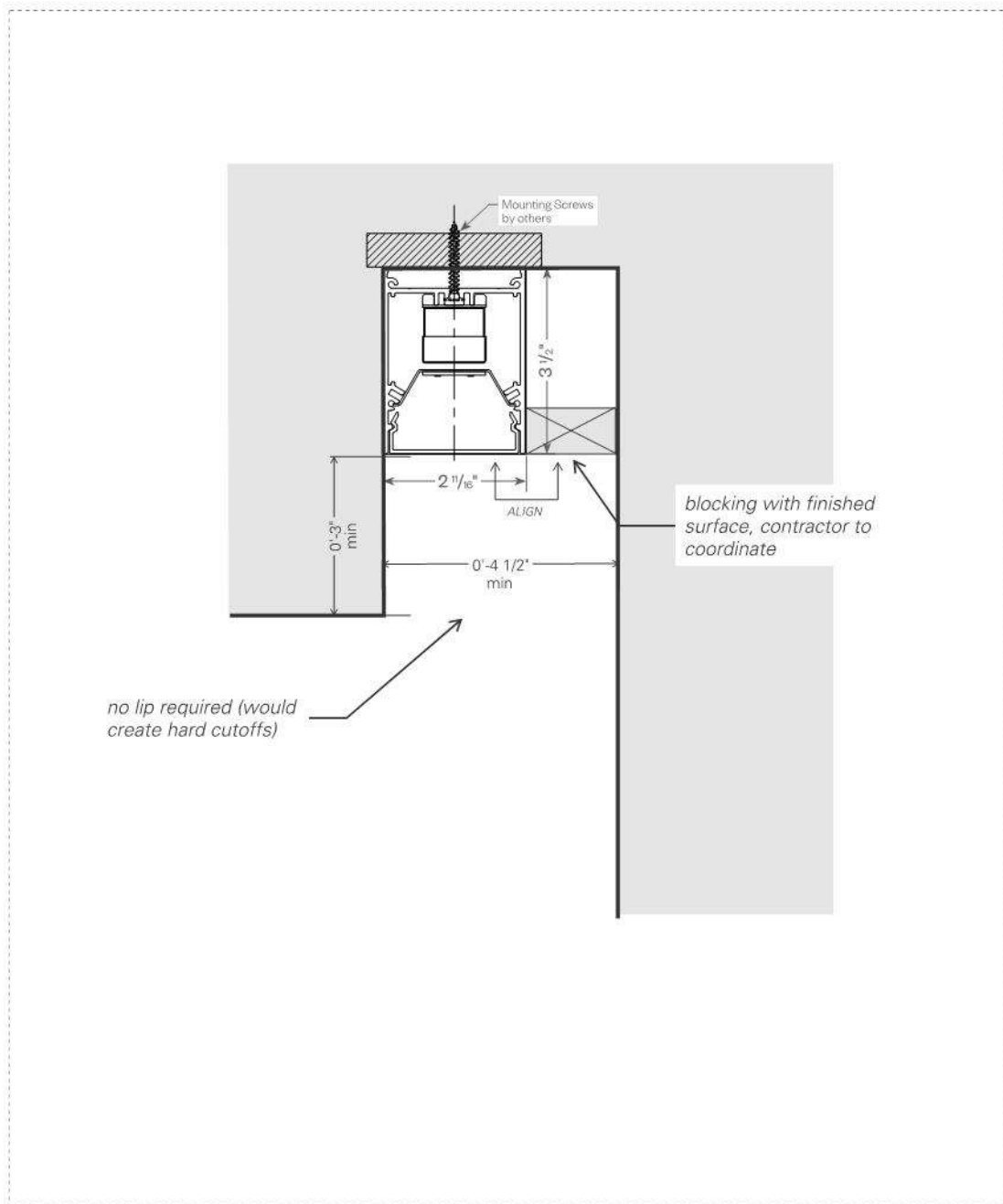
LIT-2036 - 02/05/19 - Page 7 of 12
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Type: TH
Sheet: 7 of 7

North Waterfront Park

11/26/2019 10:58:07 AM



TK DETAIL
Scale_ as drawn

NWP
2019.07.09

SEE FIXTURE SCHEDULE FOR CATALOG NUMBER AND DESCRIPTION

Type: TK
Sheet: 1 of 6

North Waterfront Park

11/26/2019 10:58:07 AM

Linea® 2.5"

Linear Direct LED



Linea 2.5" Direct

Features

Linea 2.5" drives your design scenario, seamlessly. Streamlined and flexible, these architectural LED pendants provide the freedom to create truly dynamic spaces. A synthesis of aesthetics, performance and energy efficiency, the Linea family delivers on its promises. Linea 2.5" complements our Gruv 2.5" products.

Product Overview

Type:	Cable Suspended, Wall or Surface Direct
Wattage:	5W/ft, 10W/ft (other wattages available see p2)
Lumen Output:	3,873 max; 93.2 Lm/W (10W, 4ft fixture)
Color Temp:	2700K, 3000K, 3500K, 4000K
CRI:	83 typ. (2700K, 3000K, 3500K, 4000K)
Dimming:	0-10V, 1% dim (standard) Lutron Hi-lume® 2 wire (120V only) Lutron Hi-lume® EcoSystem, 1% dim, fade to off Lutron Hi-lume® 5 Series DALI dimming, 0.1% dim

PROJECT:

TYPE:

Fixture Summary *(see following pages for more information)*

Performance Chart

Wattage Per Foot	Delivered Lumens	LPW	Color Temp
5	2,053	103.2	3000K
10	3,873	93.2	3000K

Data is based on 3500K-83 IES files available on website
Data is based on 4' fixture with Performance Lens

Runs

Individual Runs: 2' - 8' (whole foot standard)

Continuous Runs: Available (whole foot standard)

Custom: Made to measure available (nearest 1/8" of field dimensions).

Requires approval drawings. Added cost & lead time.

Electrical Data

Wattage Per Foot		4'		8'	
		System Watts	Amps	System Watts	Amps
5	120V	22.3	0.18	41.9	0.35
	277V	22.9	0.09	41.8	0.16
10	120V	42.1	0.35	84.2	0.70
	277V	41.5	0.15	83.0	0.30

Electronic multi-volt (120V-277V), constant current LED driver

Standard Patterns

"L"	"J"	"U"	"O"	"Z"	Wall to Ceiling	Custom*
Yes	Yes	Yes	Yes	Yes	No	Yes

* Submit drawing, consult factory

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SEE FIXTURE SCHEDULE FOR CATALOG NUMBER AND DESCRIPTION

Type: TK
Sheet: 2 of 6

North Waterfront Park

11/26/2019 10:58:07 AM

Linea® 2.5" Direct

Linear Direct LED



Linea 2.5" Direct

PROJECT:

TYPE:

Ordering Information

LIN2.5D-A16						120/277				
1	2	3	4	5	6	7	8	9	10	11

- 1 Model**
LIN2.5D-A16*
- 2 Optics**
PL - performance lens (standard)
DL - designer lens
- 3 Mounting**
ASW10 - through ceiling tile or gyp board, white, 10'
ASW20 - through ceiling tile or gyp board, white, 20'
ASB10 - through ceiling tile or gyp board, black, 10'
ASB20 - through ceiling tile or gyp board, black, 20'
ASW10T - over ceiling tee, white, 10'
ASW20T - over ceiling tee, white, 20'
ASB10T - over ceiling tee, black, 10'
ASB20T - over ceiling tee, black, 20'
WM - wall mount
SM - surface mount
- 4 Wattage (per foot)**
Standard:
5 - 5W/ft
10 - 10W/ft
Optional:
3 - 3W/ft (4' minimum length required)
4 - 4W/ft (4' minimum length required)
6 - 6W/ft
7 - 7W/ft
8 - 8W/ft
9 - 9W/ft
- 5 Color Temp**
83 CRI:
27 - 2700K-83
30 - 3000K-83
35 - 3500K-83
40 - 4000K-83
92 CRI optional, consult factory
- 6 Finish**
HW - high reflectance matte white
BT - black texture
ST - silver texture
For other RAL color, consult factory
- 7 Voltage**
120/277
- 8 Length**

(Length A)	(Length B)	(Length C)
Length A (used for)	Length B (used for)	Length C (used for)
- all patterns	- all patterns	- PU
- IND	- PR - 2 lengths of 2	- PZ
- CON		
- CUS		
- 9 Configuration**
IND¹ - individual fixture, 2' to 8' in 1' increments
CON - continuous run > than 8', specify to nearest foot
CUS - custom made to measure, +/- 1/8" of customer supplied field dimensions
Standard Patterns (see page 6 for details):
PLL - L left, (2) straights + (1) 90° corner, leg right
PLR - L right, (2) straights + (1) 90° corner, leg left
PU - U shape, (3) straight lengths + (2) 90° corners
PR - Rectangle, (4) straight lengths + (4) 90° corners
PZ - Z shape, (3) straight lengths + (2) 90° corners
Custom Patterns:
PC - please provide drawings and consult factory
- 10 Drivers**
0-10V - 1% electronic dimming, multi-volt (120V-277V) constant current driver (standard).
HILUME-A-LTE - Lutron "A" Series, 1% dim, 2-wire, 120V only
HILUME-H-ECO - Lutron "H" Series, 1% dim, fade to off, EcoSystem
HILUME-5-ECO - Lutron "5" Series, EcoSystem
DALI - DALI Dimming 120V-277V, 0.1% dim
- 11 Options/Accessories**
ENLS - Enlighted Sensor (0-10V driver only and not available on 2' & 3' lengths)
EMC-PF² - emergency circuit requires power feed located in last fixture section (for other locations consult factory)
PF² - Extra power feed for additional circuiting

1 - Lengths less than 4' may have restrictions based upon wattage, lengths, drivers or other options.

2 - Not available with IND (individual) configuration.

* The "A" refers to the sequential revision in a year and "XX" refers to the year of update. Updates coincide with improved performance while not changing the overall fixture aesthetic and are reflected in the published performance data. Please contact your Amerlux representative for explanations of changes.

Linea® 2.5" Direct

Linear Direct LED



Linea 2.5" Direct

PROJECT:

TYPE:

Specifications

Application

Open office plan, conference rooms, corridors or any indoor space where the higher light levels of a direct ambient lighting system are required.

Construction

One piece extruded aluminum housing. Die-cast End Plates match fixture body finish. Die-formed, cold-rolled steel internal components are protected against rust and corrosion.

Optical

All lenses are snap-in, extruded acrylic, with a maximum length of 8'. Amerlux's proprietary acrylic lens provide excellent transmission while effectively concealing source image.

PL - Performance Lens provides high efficiency with controlled lens surface brightness (standard).

DL - Designer Lens provides flat even glow on lens. Best when lens is in direct view.

LED

Amerlux's boards and patented connector design with brand name LEDs enables Amerlux fixtures to have excellent thermal management and offer a 5 year warranty. Our LED binning is within 3 MacAdam ellipse. Boards are configured for maximum flexibility resulting in even illumination no matter the fixture layout. LED boards are easily replaced in the field with just a Phillips screw driver.

Color Temperature Options:

2700K, 3000K, 3500K, 4000K

CRI: 83 typical, 92 optional - consult factory

R9: 16 @ CRI 83

R9: >50 @ CRI 92

Life: 50,000+ hr., > 70% of initial lumens (L70)

Electrical

Wiring: Individual and "Beginning of Run" (BOR) fixtures are prewired with power cord. All configurations have quick connect power harnesses for row connections.

Standard Wattage: 5W/ft, 10W/ft.

Optional Wattages: 3W/ft, 4W/ft, 6W/ft, 7W/ft, 8W/ft, 9W/ft. (3W & 4W have a minimum length of 4'). For other wattages consult factory. Emergency circuit via remote inverter or auxiliary emergency power supply (by others).

This product complies with IEEE C62.41 for surge endurance up to 2.5KV. Amerlux® recommends using additional surge protection with this unit (supplied by others), surge and over voltage damage is not covered under warranty.

EMC-PF - Emergency circuit requires power feed to be located in last fixture section for continuous runs. For other locations consult factory. Not available for individual (IND) configuration.

PF - Extra power feed for additional circuiting. Not available for individual (IND) configuration.

Drivers

0-10V - 1% electronic dimming, multi-volt (120V-277V) constant current driver (standard). Cap leads for non-dim applications.

Optional Drivers:

HILUME-A-LTE - Lutron "A" Series, 1% dim, 2-wire, 120V only

HILUME-H-ECO - Lutron "H" Series, 1% dim, fade to off, EcoSystem

HILUME-S-ECO - Lutron "S" Series, EcoSystem

DALI - DALI Dimming 120V-277V, 0.1% dim

Finish

All painted surfaces are premium powder coated baked on for maximum durability and color stability.

HW - High reflective matte White

BT - Black Texture

ST - Silver Texture

For special paint colors supply RAL and/or actual paint chip for factory consultation.

Configurations/Lengths

IND - Individual fixtures are made of single standard lengths of 2 ft to 8 ft (in 1' increments). These are stand alone fixtures with matching End Caps, supplied with the mounting hardware. Lengths less than 4' may have restrictions based upon wattage, lengths, drivers or other options.

CON - Continuous runs, > 8', specified to nearest whole foot length in 1' increments. Runs made from standard lengths have End Caps at the beginning and end of run. Runs > 60' may require second power feed. Each Housing has factory installed alignment pins. Mating fixtures are easily aligned and joined. Wiring is made fast and positive with molded quick connectors.

CUS - Custom made to measure runs are made to nearest 1/8" of customer supplied field measurements or drawings. Custom lengths use the same hardware for hairline joining.

PXX - Standard Patterns consist of 90° corners with standard lengths (4' to 8' in 1' increments), continuous runs or made to measure lengths. Depending upon complexity of the pattern drawings may be required from the Customer. If ordering please give overall lengths.

A'-B'-PLL - L Left - (1) 90° Corner 2 segments. Specify overall segments: A' & B'

A'-B'-PLR - L Right - (1) 90° Corner 2 segments. Specify overall segments: A' & B'

A'-B'-PR - Rectangle - (4) 90° Corners joining 4 segments. Specify overall segments: A', B', & C'

A'-B'-C'-PU - U shape - (2) 90° Corners joining 3 segments. Specify overall segments: A', B', & C'

A'-B'-C'-PZ - Z shape - (2) 90° Corners joining 3 segments. Specify overall segments: A', B', & C'

See page 6 for layouts.

PC - Custom Patterns may use standard lengths, Made To Measure, 90° or other corners (some limitations). Please provide drawing and consult factory.

Mounting

The Linea 2.5 Direct is intended to be pendant, wall, or surface mounted in continuous rows. Standard or custom patterns available.

LIN2.5D-A16...ASW10 - Direct pendant installed in center of ceiling tile or gypsum board ceiling, (standard) i.e. ASW10. Or if canopy is installed on a grid Tee runner add, **T** i.e. ASW10T

Cable Suspension: Cable is stranded stainless steel wire. All fittings are protected against rust and corrosion. Canopies are 5" x 1/4" die formed painted steel. Adjustment mechanism allows for infinite height adjustment. Amerlux recommends the required feed and non-feed suspensions based upon length and electrical options. Options include: color of canopy and power cord (black or white), length 10' or 20', and mounting condition, in center of ceiling tile and in gypsum board ceiling (standard) i.e. ASW10. Or if canopy is installed on a grid Tee runner add, **T** i.e. ASW10T

LIN2.5D-A16...WM - Direct Wall Mount using steel cleat bracket attached to fixture housing and wall bracket with set screws. Two bracket assemblies are used for each length under 8'. A third center bracket may be recommended. J box required at feed locations.

LIN2.5D-A16...SM - Direct Surface Mounted - Housing needs to be attached to solid structure above. Mounting holes are pre-drilled at factory. Some fixture disassembly and reassembly required. Mounting hardware by others.

Certifications

Approved to UL standards for damp locations as tested by CSA
Intended for indoor use only

Warranty

Amerlux's 5 year limited warranty. Please consult Amerlux website for details.

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Type: TK
Sheet: 4 of 6

North Waterfront Park

11/26/2019 10:58:07 AM

Linea® 2.5" Direct

Linear Direct LED

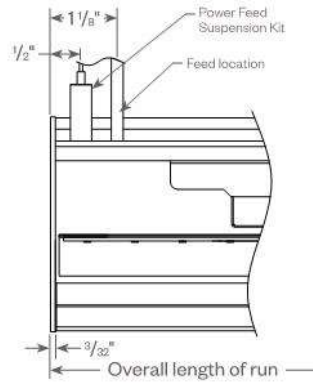
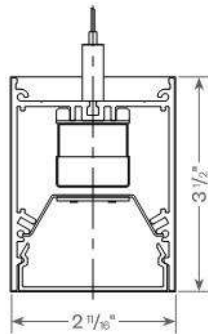


Linea 2.5" Direct

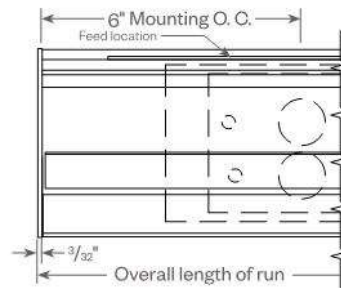
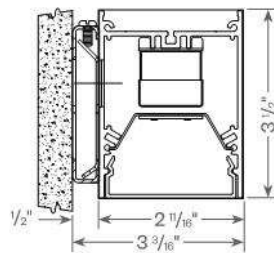
PROJECT:

TYPE:

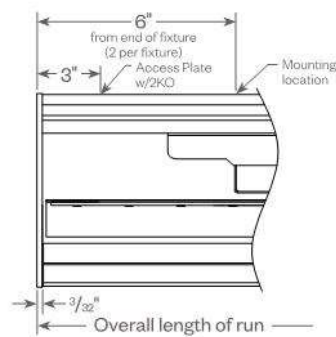
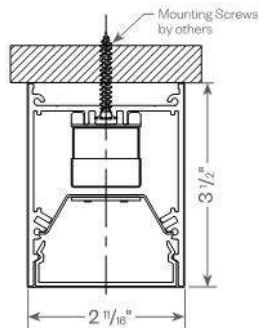
LINEA 2.5" DIRECT



LINEA 2.5" DIRECT WALL MOUNT



LINEA 2.5" DIRECT SURFACE MOUNT



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SEE FIXTURE SCHEDULE FOR CATALOG NUMBER AND DESCRIPTION

Type: TK
Sheet: 5 of 6

North Waterfront Park

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Linea® 2.5" Direct

Linear Direct LED



Linea 2.5" Direct

PROJECT:

TYPE:

DIMMING COMPATIBILITY:

Amerlux® Linea fixtures are compatible with all major dimming protocols prevalent in the United States. Please see below for general compatibilities and wiring diagrams. Amerlux recommends testing your unique dimming configuration as the exact full configuration (Dimmer, Fixture Quantity, Voltage, etc) may affect dimming performance.

--- NOTE: INFORMATION BELOW IS FOR WIRED DIMMERS ONLY. FOR WIRELESS DIMMERS, CONSULT FACTORY ---

0-10V - DIMMING (Standard)

Integrates into a variety of building management and daylighting controls

Notes:

- 120V or 277V*
- Dims down to 1% light output
- Requires interface to turn off power to driver
- Consult Dimming manufacturer for installation instructions - DO NOT SHARE NEUTRALS!

Compatible Dimmers*:

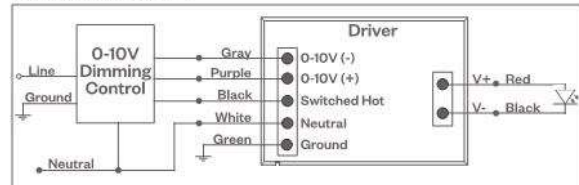
Wall Box

Lutron:	Wattstopper:	Leviton:
Diva - DVSTV	ADF-120277	Renoir II
Maestro - MS-Z101		
Nova-T - NTSTV-DV		

Center System

Lutron Grafikk Eye with GRX-TV1 Interface

0-10V Wiring Diagram



LUTRON HI-LUME DIMMING

Integrates into Lutron EcoSystem building management

Notes:

- 120V or 277V*
- Dims down to less than 5% light output
- EcoSystem Control
- Consult Dimming manufacturer for installation instructions - DO NOT SHARE NEUTRALS!

Compatible Dimmers*:

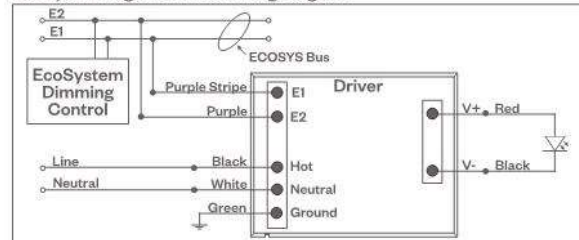
Wall Box

Lutron:
Diva
Maestro
Nova-T
Vareo

Center System

Lutron EcoSystem compatible controls

HILUME-H-ECO, HILUME-5-ECO EcoSystem Digital Control Wiring Diagram



Notes:

- * Driver is 277V dimmable with appropriate dimmer (by others). All provided wiring diagrams show 120V wiring colors and method. Please refer to 277V dimmer installation instructions for 277V wiring diagrams.
- † The absence of a dimmer from the lists above does not imply incompatibility. Please consult factory for compatibility inquiries.

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Type: TK
Sheet: 6 of 6

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TARGETTI

KEPLERO MINI ZOOM Flexibility

Professional Inground LED Fixture

Concept: Professional single LED COB fully adjustable landscape inground fixture. As landscaping matures and changes, shape and size zoom optics can be adjusted in beam spread and direction to adjust with the changing landscape.

Housing: 8" tall x 6.625" diameter die-cast aluminum housing.

Materials: Anodized and powder coated black die-cast aluminum heat sink body, PVC installation sleeve and stainless steel (AISI316L) trim ring with extra clear glass.

Trim: Ultra flat round or square decorative ring with beveled edge in brushed natural, bronze or black finishes. Features tamper-proof Torx screws.

Optic: Zoom optical system which slides and locks on vertical axis according to four different positions to provide four different beam apertures; 15°, 32°, 53° and 63° beam spreads. Light beam can be tilted 20° on the vertical plane and rotated 350° on the horizontal plane with integral locking system.

Mounting: Flush and semi-flush installation sleeves or optional raised installation tube for landscape. Fixture includes screw down holes and stainless steel screws for attachment to installation sleeve. Includes optional stainless steel L brackets for mounting support. Installation sleeve required for flush or semi-flush mounting.

Driver: Integrated universal voltage IP68 electronic driver complete with watertight IP68 connector cable (0-10V dimming available)

Installation: Fixture flush mount installation includes 8" tall x 6.625" diameter sleeve, extension pipe for wire slack and accessibility. Fixture is provided with 6ft IP68 connector cable, direct burial brass ingrade jbox (required, sold separately).

Wattage: 15W

Color Temperature: 3000 K / 4000 K

CRI: 84 CRI

Lumen Maintenance (L70): 50,000hrs

Calculation for LED fixtures are based on measurements that comply with IES LM-80.

Voltage: Universal Voltage 120-277V AC 50/60Hz

IK Rating: IK10

IP Rating: IP68**

Load Rating: Resistant to static loads up to 20KN in flush mounted cement and pavement installations.

Certifications: cULus Wet Listed E477426

Tested in accordance with LM-79-08

^A Title 24 commercial installation compliant.

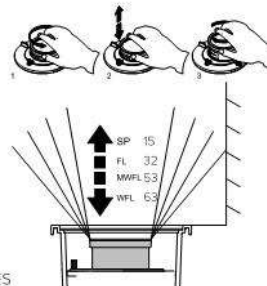
Warranty: 5 year limited warranty

* Up to 1 METER DEPTH of water for up to a maximum of 30 MINUTES

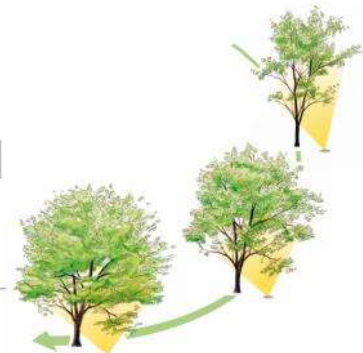
** Not suitable for submersible installations



KEPLERO® Mini Zoom with Clear Lens



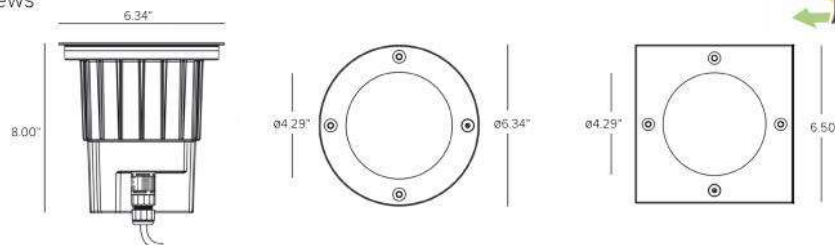
Lumens:	3000K	4000K
Spot 15	= 576Lm	628Lm
Flood 32	= 750Lm	776Lm
Medium Wide Flood 53	= 1001Lm	968Lm
Wide Flood 63	= 1042Lm	1138Lm



PRODUCT CODE	DRIVER	TYPE	WATTAGE	COLOR TEMP	TRIM & INSTALLATION
KPLM - KEPLERO Mini	ND - Non-dimming driver	ZM - Zoom	L2 - 15W	30 - 3000K	Required (See Pg 2)
	10 - 0-10V Dimming			40 - 4000K	

QUICK SHIP 1-2 weeks
KPLMNDZML230-QS + 1E2525-QS + 1DU2521-QS + 1DU2530-QS
Lead time for quick ship fixtures is 1-2 weeks from processed PO date. Consult factory for quantities of over 20 fixtures to confirm lead time.

Views



TARGETTI

KEPLERO MINI ZOOM

TRIM RING (REQUIRED) - CHOOSE 1		OPTICAL ACCESSORIES:	
1E2525	Round brushed natural stainless steel (AISI316L) decorative ring. 10mm thick extra clear protective glass. Silicone gasket. Tamper proof (AISI316L) Torx screws.	Maximum of one optical filter or louver accessory per fixture.	
1DU2525B	Round brushed bronze stainless steel (AISI316L) decorative ring. 10mm thick extra clear protective glass. Silicone gasket. Tamper proof (AISI316L) Torx screws.	1T1712	Chromatic filter Red. Glass made, with dichroic treatment. Diameter 2.8".
1DU2525K	Round Black stainless steel (AISI316L) decorative ring. 10mm thick extra clear protective glass. Silicone gasket. Tamper proof (AISI316L) Torx screws.	1T1713	Chromatic filter Green. Glass made, with dichroic treatment. Diameter 2.8".
1E2526	Square brushed natural stainless steel (AISI316L) decorative ring. 10mm thick extra clear protective glass. Silicone gasket. Tamper proof (AISI316L) Torx screws.	1T1714	Chromatic filter Blue. Glass made, with dichroic treatment. Diameter 2.8".
1DU2526B	Square brushed bronze stainless steel (AISI316L) decorative ring. 10mm thick extra clear protective glass. Silicone gasket. Tamper proof (AISI316L) Torx screws.	1T1715	Chromatic filter Yellow. Glass made, with dichroic treatment. Diameter 2.8".
CONSULT FACTORY	Square Black stainless steel (AISI316L) decorative ring. 10mm thick extra clear protective glass. Silicone gasket. Tamper proof (AISI316L) Torx screws.	1T1716	Chromatic filter Magenta. Glass made, with dichroic treatment. Diameter 2.8".
INSTALLATION SLEEVE (REQUIRED) - CHOOSE 1		1T1777	Chromatic filter Cold tone. Interference glass filter to vary the colour temperature of light. Diameter 2.8".
1DU2521	Installation sleeve for concrete pour applications. Grey Nylon 8" casing with 10" PVC installation outer pipe. Round ring for flush or semi-flush installations.	1T1786	Chromatic filter Gold tone. Interference glass filter to vary the colour temperature of light. Diameter 2.8".
1DU2522	Installation sleeve for concrete pour applications. Grey Nylon 8" casing and stainless steel profile with 10" PVC installation outer pipe. Square ring for flush installation only. For use with square trim options only.	1T1759	Chromatic filter Peach tone. Interference glass filter to vary the colour temperature of light. Diameter 2.8".
1DU434436	Raised installation sleeve for landscape applications. 36"H black stainless steel, includes 8" inner sleeve. To be used with round trim options. (Field cuttable. Used for fixture elevation 21" above ground). Not suitable with 1DU2521 and 1DU2522.	1T1708	Parallel ribbed glass light blade filter. This makes the beam take on an oval shape and when combined with spotlights, the light blade appears more prominent. Diameter 2.8".
1DU434418	Raised installation sleeve for ground cover (succulents and low level planting) applications. 18"H black stainless steel, includes 8" inner sleeve. To be used with round trim options. (Field cuttable. Used for fixture elevation 7" above ground). Not suitable with 1DU2521 and 1DU2522.	1T1711	Anti-glare grid. Black lacquered metal honeycomb structure. Diameter 2.8".
1DU434412	Raised installation sleeve for turf applications. 12"H black stainless steel, includes 8" inner sleeve. To be used with round trim options. (Field cuttable. Used for fixture elevation 3" above ground). Not suitable with 1DU2521 and 1DU2522.	1E2523	Half Moon Anti glare shutter. Black finish. Can be used as one per fixture with a filter or louver, not considered as part of the maximum optical accessories.
		INSTALLATION ACCESSORIES:	
			
			
			
Round Trim Ring	Square Trim Ring	Chromatic Filters	Tonal Filters
1DU2521	1E2495	1T1708	1T1711
1DU2530	1E2524	1E0388	1E2523

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SEE FIXTURE SCHEDULE FOR CATALOG NUMBER AND DESCRIPTION

Type: TM-ALT
Sheet: 2 of 5

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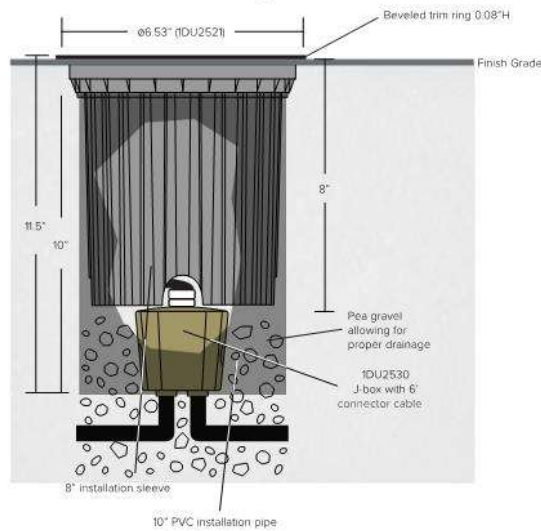
KEPLERO MINI ZOOM

Installation Diagram - Concrete Pour Application

Flush Mount Sleeve Assembly 1DU2521 and 1DU2522 Sleeves



Semi-Flush Mount Sleeve Assembly 1DU2521 Sleeve Only



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SEE FIXTURE SCHEDULE FOR CATALOG NUMBER AND DESCRIPTION

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Sheet: 3 of 5

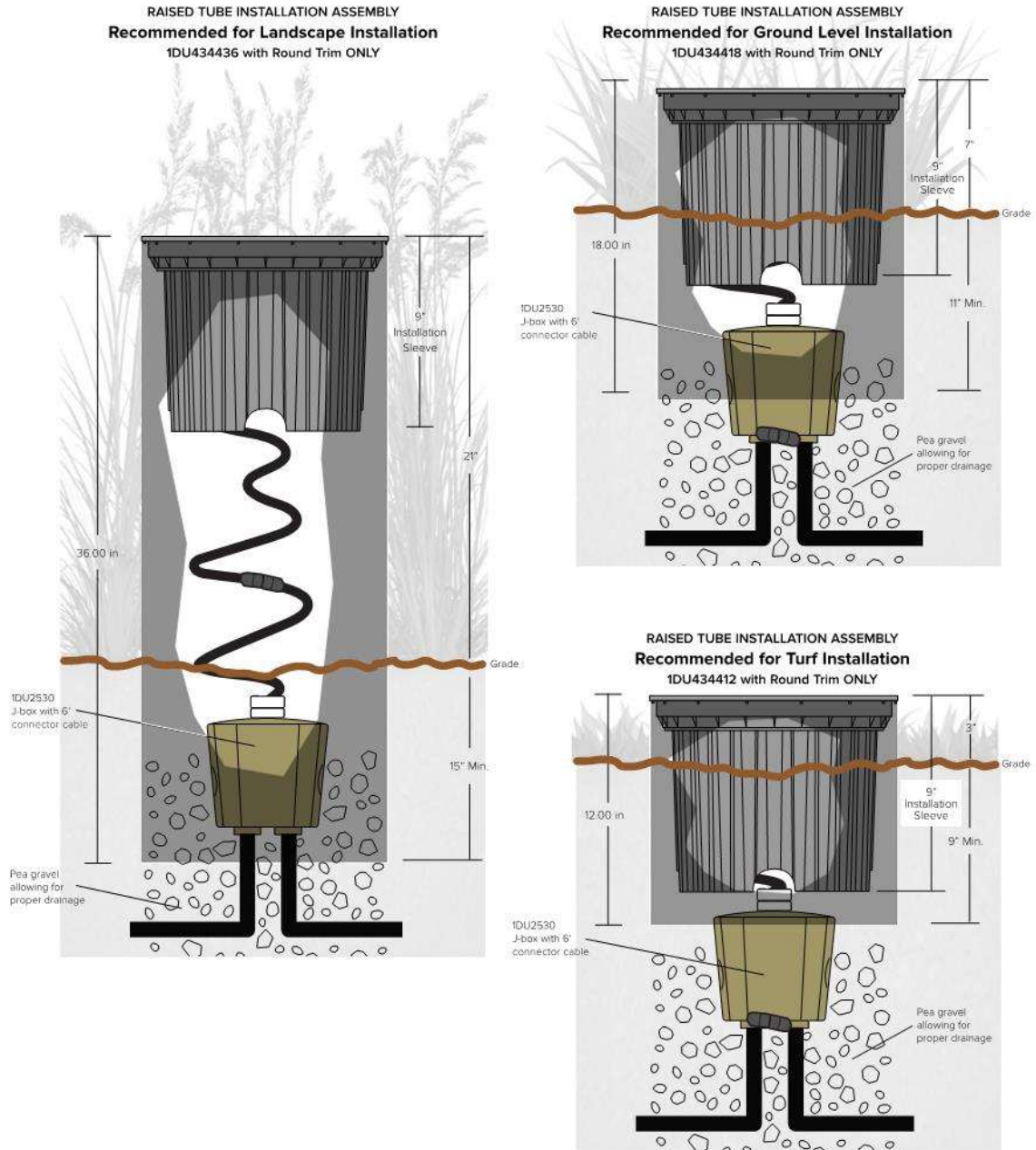
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Installation Diagram - Landscape Application



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Sheet: 4 of 5

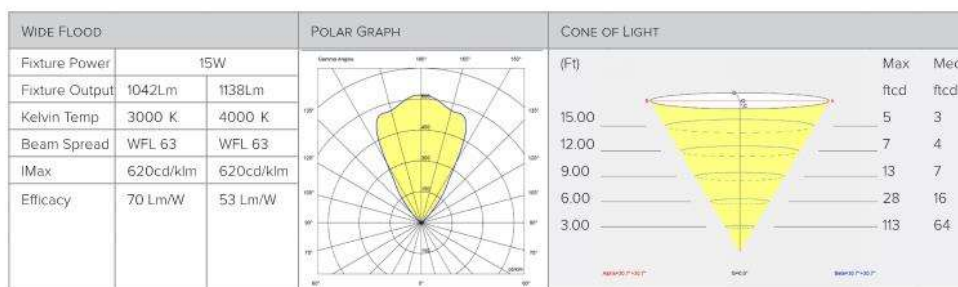
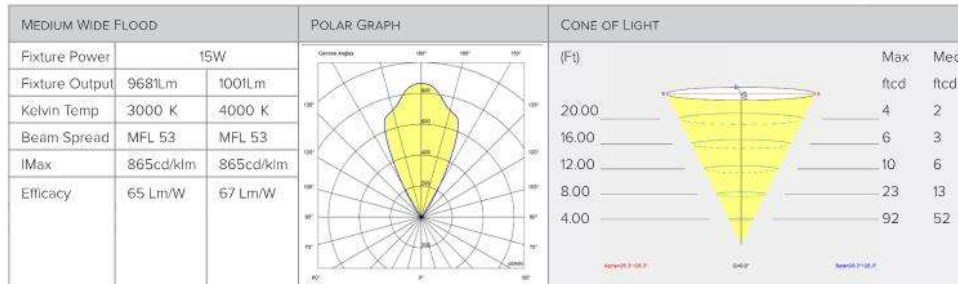
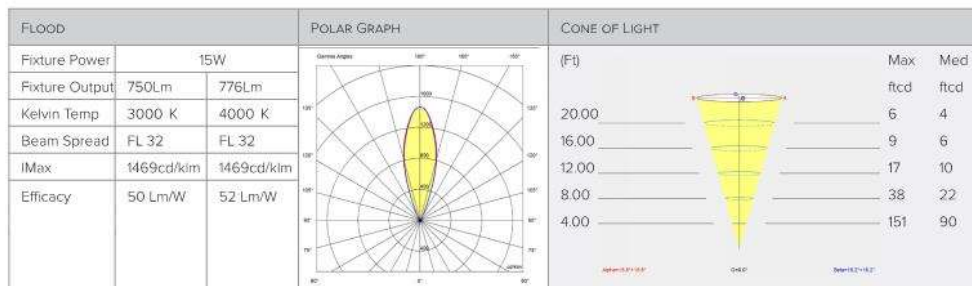
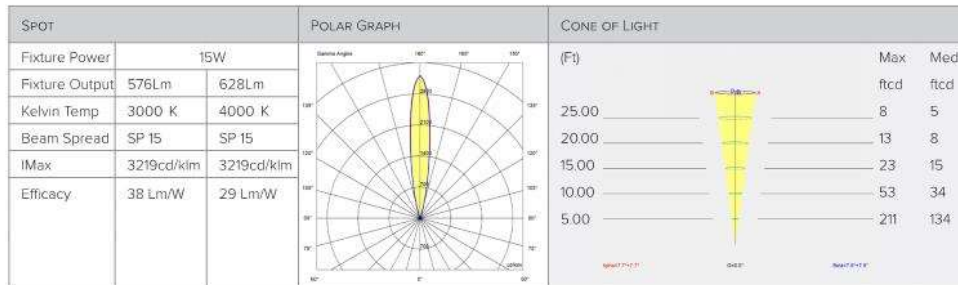
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TARGETTI

KEPLERO MINI ZOOM

Photometry



Linea® 2.5"

Linear Direct LED



Linea 2.5" Direct

Features

Linea 2.5" drives your design scenario, seamlessly. Streamlined and flexible, these architectural LED pendants provide the freedom to create truly dynamic spaces. A synthesis of aesthetics, performance and energy efficiency, the Linea family delivers on its promises. Linea 2.5" complements our Gruv 2.5" products.

Product Overview

Type:	Cable Suspended, Wall or Surface Direct
Wattage:	5W/ft, 10W/ft (other wattages available see p2)
Lumen Output:	3,873 max; 93.2 Lm/W (10W, 4ft fixture)
Color Temp:	2700K, 3000K, 3500K, 4000K
CRI:	83 typ. (2700K, 3000K, 3500K, 4000K)
Dimming:	0-10V, 1% dim (standard) Lutron Hi-lume® 2 wire (120V only) Lutron Hi-lume® EcoSystem, 1% dim, fade to off Lutron Hi-lume® 5 Series DALI dimming, 0.1% dim

PROJECT:

TYPE:

Fixture Summary *(see following pages for more information)*

Performance Chart

Wattage Per Foot	Delivered Lumens	LPW	Color Temp
5	2,053	103.2	3000K
10	3,873	93.2	3000K

*Data is based on 3500K-83 IES files available on website
Data is based on 4' fixture with Performance Lens*

Runs

Individual Runs: 2' - 8' (whole foot standard)

Continuous Runs: Available (whole foot standard)

Custom: Made to measure available (nearest 1/8" of field dimensions).

Requires approval drawings. Added cost & lead time.

Electrical Data

Wattage Per Foot		4'		8'	
		System Watts	Amps	System Watts	Amps
5	120V	22.3	0.18	41.9	0.35
	277V	22.9	0.09	41.8	0.16
10	120V	42.1	0.35	84.2	0.70
	277V	41.5	0.15	83.0	0.30

Electronic multi-volt (120V-277V), constant current LED driver

Standard Patterns

"L"	"J"	"U"	"O"	"Z"	Wall to Ceiling	Custom*
Yes	Yes	Yes	Yes	Yes	No	Yes

* Submit drawing, consult factory

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5 year limited warranty
AMERLUX LED



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Type: TP
Sheet: 1 of 5

North Waterfront Park

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Linea® 2.5" Direct

Linear Direct LED



Linea 2.5" Direct

PROJECT:

TYPE:

Ordering Information

LIN2.5D-A16 . 120/277 .										
1	2	3	4	5	6	7	8	9	10	11

1 Model

LIN2.5D-A16†

2 Optics

PL - performance lens (standard)
DL - designer lens

3 Mounting

ASW10 - through ceiling tile or gyp board, white, 10'
ASW20 - through ceiling tile or gyp board, white, 20'
ASB10 - through ceiling tile or gyp board, black, 10'
ASB20 - through ceiling tile or gyp board, black, 20'
ASW10T - over ceiling tee, white, 10'
ASW20T - over ceiling tee, white, 20'
ASB10T - over ceiling tee, black, 10'
ASB20T - over ceiling tee, black, 20'
WM - wall mount
SM - surface mount

4 Wattage (per foot)

Standard:

5 - 5W/ft
10 - 10W/ft

Optional:

3 - 3W/ft (4' minimum length required)
4 - 4W/ft (4' minimum length required)
6 - 6W/ft
7 - 7W/ft
8 - 8W/ft
9 - 9W/ft

5 Color Temp

83 CRI:

27 - 2700K-83
30 - 3000K-83
35 - 3500K-83
40 - 4000K-83

92 CRI optional, consult factory

6 Finish

HW - high reflectance matte white
BT - black texture
ST - silver texture

For other RAL color, consult factory

7 Voltage

120/277

8 Length

x x		
(Length A)	(Length B)	(Length C)
Length A (used for)	Length B (used for)	Length C (used for)
- all patterns	- all patterns	- PU
- IND	- PR - 2 lengths of 2	- PZ
- CON		
- CUS		

9 Configuration

IND¹ - individual fixture, 2' to 8' in 1' increments
CON - continuous run > than 8', specify to nearest foot
CUS - custom made to measure, +/- 1/8" of customer supplied field dimensions

Standard Patterns (see page 6 for details):

PLL - L left, (2) straights + (1) 90° corner, leg right
PLR - L right, (2) straights + (1) 90° corner, leg left
PU - U shape, (3) straight lengths + (2) 90° corners
PR - Rectangle, (4) straight lengths + (4) 90° corners
PZ - Z shape, (3) straight lengths + (2) 90° corners

Custom Patterns:

PC - please provide drawings and consult factory

10 Drivers

0-10V - 1% electronic dimming, multi-volt (120V-277V) constant current driver (standard).

HILUME-A-LTE - Lutron "A" Series, 1% dim, 2-wire, 120V only

HILUME-H-ECO - Lutron "H" Series, 1% dim, fade to off, EcoSystem

HILUME-5-ECO - Lutron "5" Series, EcoSystem

DALI - DALI Dimming 120V-277V, 0.1% dim

11 Options/Accessories

ENLS - Enlighted Sensor (0-10V driver only and not available on 2' & 3' lengths)

EMC-PF² - emergency circuit requires power feed located in last fixture section (for other locations consult factory)

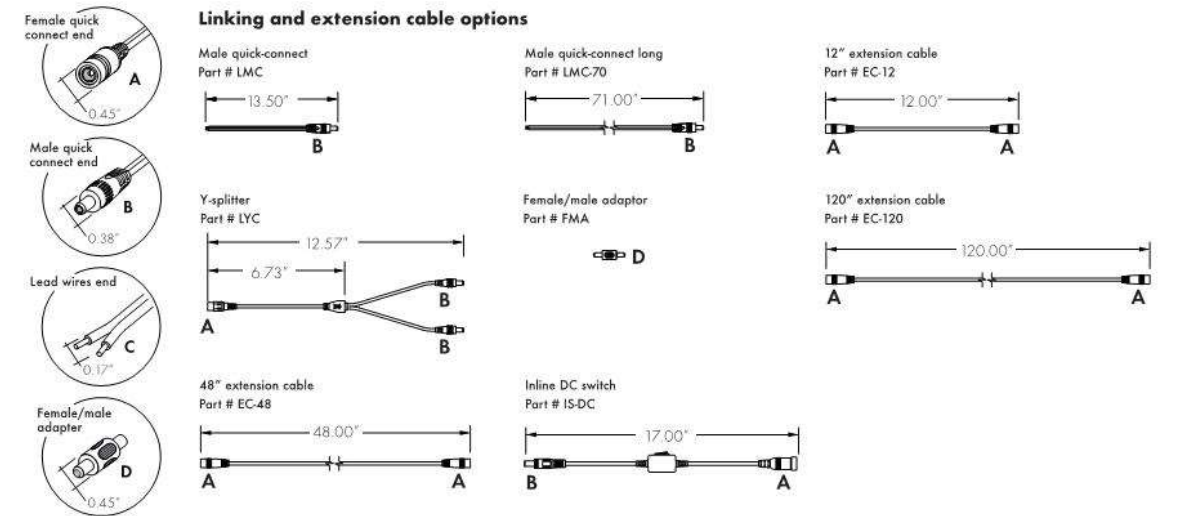
PF² - Extra power feed for additional circuiting

1 - Lengths less than 4' may have restrictions based upon wattage, lengths, drivers or other options.

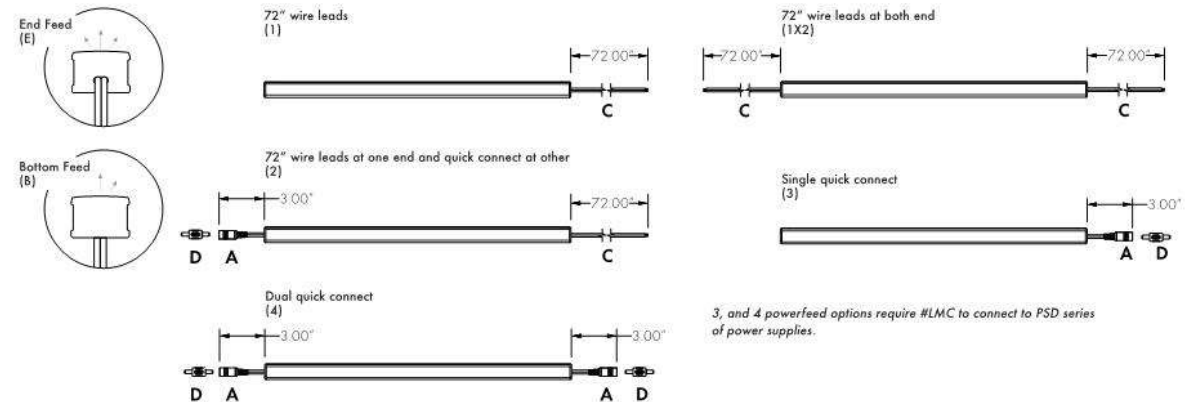
2 - Not available with IND (individual) configuration.

† The "A" refers to the sequential revision in a year and "XX" refers to the year of update. Updates coincide with improved performance while not changing the overall fixture aesthetic and are reflected in the published performance data. Please contact your Amerlux representative for explanations of changes.

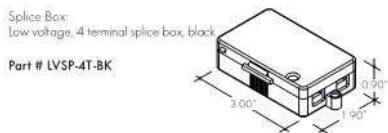
Connectors & Accessories



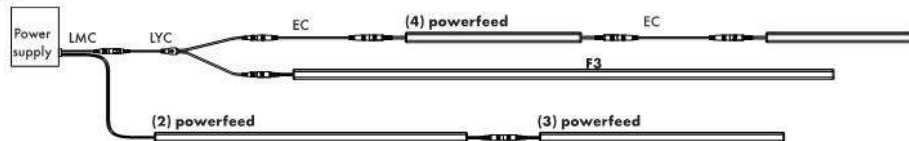
Powerfeed Position / Type



Accessory options



Sample layout



REVO.0 10292018

page 3 of 6

www.luminii.com tel. 224-333-6033

Linea® 2.5" Direct

Linear Direct LED



Linea 2.5" Direct

PROJECT:

TYPE:

Specifications

Application

Open office plan, conference rooms, corridors or any indoor space where the higher light levels of a direct ambient lighting system are required.

Construction

One piece extruded aluminum housing. Die-cast End Plates match fixture body finish. Die-formed, cold-rolled steel internal components are protected against rust and corrosion.

Optical

All lenses are snap-in, extruded acrylic, with a maximum length of 8'. Amerlux's proprietary acrylic lens provide excellent transmission while effectively concealing source image.

PL - Performance Lens provides high efficiency with controlled lens surface brightness (standard).

DL - Designer Lens provides flat even glow on lens. Best when lens is in direct view.

LED

Amerlux's boards and patented connector design with brand name LEDs enables Amerlux fixtures to have excellent thermal management and offer a 5 year warranty. Our LED binning is within 3 MacAdam ellipse. Boards are configured for maximum flexibility resulting in even illumination no matter the fixture layout. LED boards are easily replaced in the field with just a Phillips screw driver.

Color Temperature Options:

2700K, 3000K, 3500K, 4000K

CRI: 83 typical, 92 optional - consult factory

R9: 16 @ CRI 83

R9: >50 @ CRI 92

Life: 50,000+ hr., > 70% of initial lumens (L70)

Electrical

Wiring: Individual and "Beginning of Run" (BOR) fixtures are prewired with power cord. All configurations have quick connect power harnesses for row connections.

Standard Wattage: 5W/ft, 10W/ft.

Optional Wattages: 3W/ft, 4W/ft, 6W/ft, 7W/ft, 8W/ft, 9W/ft. (3W & 4W have a minimum length of 4'). For other wattages consult factory. Emergency circuit via remote inverter or auxiliary emergency power supply (by others).

This product complies with IEEE C62.41 for surge endurance up to 2.5KV. Amerlux® recommends using additional surge protection with this unit (supplied by others), surge and over voltage damage is not covered under warranty.

EMC-PF - Emergency circuit requires power feed to be located in last fixture section for continuous runs. For other locations consult factory. Not available for individual (IND) configuration.

PF - Extra power feed for additional circuiting. Not available for individual (IND) configuration.

Drivers

0-10V - 1% electronic dimming, multi-volt (120V-277V) constant current driver (standard). Cap leads for non-dim applications.

Optional Drivers:

HILUME-A-LTE - Lutron "A" Series, 1% dim, 2-wire, 120V only

HILUME-H-ECO - Lutron "H" Series, 1% dim, fade to off, EcoSystem

HILUME-S-ECO - Lutron "S" Series, EcoSystem

DALI - DALI Dimming 120V-277V, 0.1% dim

Finish

All painted surfaces are premium powder coated baked on for maximum durability and color stability.

HW - High reflective matte White

BT - Black Texture

ST - Silver Texture

For special paint colors supply RAL and/or actual paint chip for factory consultation.

Configurations/Lengths

IND - Individual fixtures are made of single standard lengths of 2 ft to 8 ft (in 1' increments). These are stand alone fixtures with matching End Caps, supplied with the mounting hardware. Lengths less than 4' may have restrictions based upon wattage, lengths, drivers or other options.

CON - Continuous runs, > 8', specified to nearest whole foot length in 1' increments. Runs made from standard lengths have End Caps at the beginning and end of run. Runs > 60' may require second power feed. Each Housing has factory installed alignment pins. Mating fixtures are easily aligned and joined. Wiring is made fast and positive with molded quick connectors.

CUS - Custom made to measure runs are made to nearest 1/8" of customer supplied field measurements or drawings. Custom lengths use the same hardware for hairline joining.

PXX - Standard Patterns consist of 90° corners with standard lengths (4' to 8' in 1' increments), continuous runs or made to measure lengths. Depending upon complexity of the pattern drawings may be required from the Customer. If ordering please give overall lengths.

A'-B'-PLL - L Left - (1) 90° Corner 2 segments. Specify overall segments: A' & B'

A'-B'-PLR - L Right - (1) 90° Corner 2 segments. Specify overall segments: A' & B'

A'-B'-PR - Rectangle - (4) 90° Corners joining 4 segments. Specify overall segments: A', B', & C'

A'-B'-C'-PU - U shape - (2) 90° Corners joining 3 segments. Specify overall segments: A', B', & C'

A'-B'-C'-PZ - Z shape - (2) 90° Corners joining 3 segments. Specify overall segments: A', B', & C'

See page 6 for layouts.

PC - Custom Patterns may use standard lengths, Made To Measure, 90° or other corners (some limitations). Please provide drawing and consult factory.

Mounting

The Linea 2.5 Direct is intended to be pendant, wall, or surface mounted in continuous rows. Standard or custom patterns available.

LIN2.5D-A16...ASW10 - Direct pendant installed in center of ceiling tile or gypsum board ceiling, (standard) i.e. ASW10. Or if canopy is installed on a grid Tee runner add, **T** i.e. ASW10T

Cable Suspension: Cable is stranded stainless steel wire. All fittings are protected against rust and corrosion. Canopies are 5" x 1/4" die formed painted steel. Adjustment mechanism allows for infinite height adjustment. Amerlux recommends the required feed and non-feed suspensions based upon length and electrical options. Options include: color of canopy and power cord (black or white), length 10' or 20', and mounting condition, in center of ceiling tile and in gypsum board ceiling (standard) i.e. ASW10. Or if canopy is installed on a grid Tee runner add, **T** i.e. ASW10T

LIN2.5D-A16...WM - Direct Wall Mount using steel cleat bracket attached to fixture housing and wall bracket with set screws. Two bracket assemblies are used for each length under 8'. A third center bracket may be recommended. J box required at feed locations.

LIN2.5D-A16...SM - Direct Surface Mounted - Housing needs to be attached to solid structure above. Mounting holes are pre-drilled at factory. Some fixture disassembly and reassembly required. Mounting hardware by others.

Certifications

Approved to UL standards for damp locations as tested by CSA
Intended for indoor use only

Warranty

Amerlux's 5 year limited warranty. Please consult Amerlux website for details.

LIT-2050 - 04/23/19 - Page 3 of 10

Amerlux reserves the right to change details that do not affect overall function and performance.
Amerlux®, LLC - 178 Bauer Drive, Oakland, NJ 07436 - P: 973-882-5010 F: 973-882-2605 - amerlux.com

SEE FIXTURE SCHEDULE FOR CATALOG NUMBER AND DESCRIPTION

Type: TP
Sheet: 4 of 5

North Waterfront Park

11/26/2019 10:58:07 AM

Linea® 2.5" Direct

Linear Direct LED

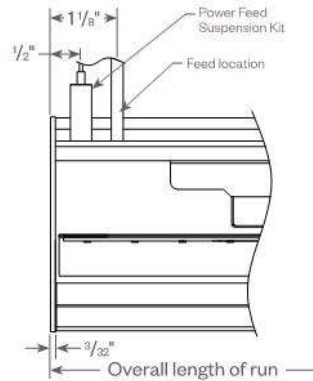
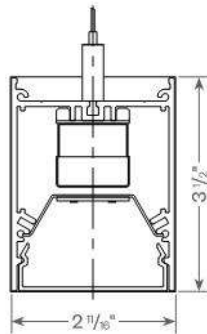


Linea 2.5" Direct

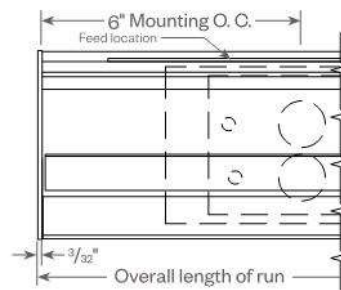
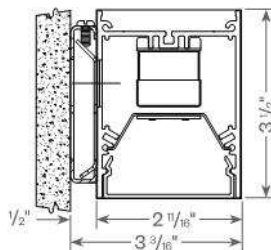
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TYPE:

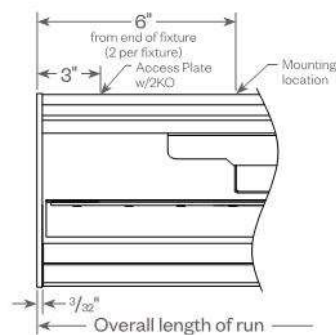
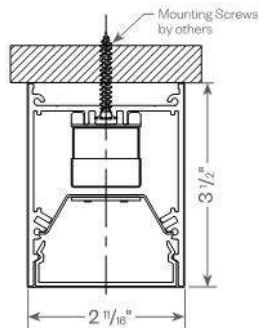
LINEA 2.5" DIRECT



LINEA 2.5" DIRECT WALL MOUNT



LINEA 2.5" DIRECT SURFACE MOUNT



LIT-2050 - 04/23/19 - Page 4 of 10

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SEE FIXTURE SCHEDULE FOR CATALOG NUMBER AND DESCRIPTION

Type: TP
Sheet: 5 of 5

North Waterfront Park

11/26/2019 10:58:07 AM

11/26/2019 10:58:07 AM

Non Electrical Housing

Code	Dimming	Max Power (DVR)	AC input	Line current	Power factor	Minimum install height
A.OMNEH.162C	N/A	-	VAC	-	-	-

Notes

1. Requires 1/2" clearance from building members, 3" clearance from any insulation
2. Refer to remodel housing for minimum install height
3. Hanger bars install on all 4 sides, expand from 13.5" to 24"
4. Hanger brackets accept FB bars, C-Channel, and 1/2" conduit for mounting
5. Non electrical housings allow fixture positioning for post ceiling installation of remodel housing

IC/Air Tight Housing

Code	Dimming	Max Power (DVR)	AC input	Line current	Power factor	Minimum install height
T.ALH60.162C	Phase Cut Dimming	37.3W	120VAC	0.34A	0.9	-
T.ALL09.162C	Lutron Fwd Phase	40W	120VAC	0.40A	0.99	-
V.ALRO2.162C	0/10V Dimming	39.4W	120/277VAC	0.32/0.14A	0.8	-

Notes

1. Requires 1/2" clearance from building members
2. Hanger bars expand from 13.5" to 24", add 3.75" to the basic dimension of the housing
3. Hanger brackets accept FB bars, C-Channel, and 1/2" conduit for mounting
4. For non-dimming, use phase cut driver with standard switch
5. IC/AT housings are CCEA - Chicago Plenum approved
6. For housings offered with Lutron EcoSystem and Forward Phase drivers, dimming is 100- 1%. Detailed information available on request.

IC Housing

Code	Dimming	Max Power (DVR)	AC input	Line current	Power factor	Minimum install height
T.I.LH60.162C	Phase Cut Dimming	37.3W	120VAC	0.34A	0.9	-
T.I.LL09.162C	Lutron Fwd Phase	40W	120VAC	0.40A	0.99	-
V.I.LR02.162C	0/10V Dimming	39.4W	120/277VAC	0.32/0.14A	0.8	-

Notes

1. Requires 1/2" clearance from building members
2. Hanger bars expand from 13.5" to 24", add 3.75" to the basic dimension of the housing
3. Hanger brackets accept FB bars, C-Channel, and 1/2" conduit for mounting
4. For non-dimming use dimming driver with standard switch
5. For housings offered with Lutron EcoSystem and Lutron Forward Phase drivers, dimming is 100- 1%. Detailed information available on request.

Non IC Open Housing

Code	Dimming	Max Power (DVR)	AC input	Line current	Power factor	Minimum install height
T.OMH60.162C	Phase Cut Dimming	37.3W	120VAC	0.34A	0.9	-
T.OMH60.162C.E	Phase Cut Dimming	37.3W	120VAC	0.34A	0.9	-
T.OML09.162C	Lutron Fwd Phase	40W	120VAC	0.40A	0.9	-
T.OML09.162C.E	Lutron Fwd Phase	40W	120VAC	0.40A	0.9	-
V.OMR01.162C	0/10V Dimming	29.4W	120VAC	0.284A	0.9	-
V.OMR01.162C.E	0/10V Dimming	29.4W	120VAC	0.284A	0.9	-
V.OMR01.162C.M	0/10V Dimming	29.4W	277VAC	0.123A	0.9	-
V.OMR01.162C.ME	0/10V Dimming	29.4W	277VAC	0.123A	0.9	-

Notes

1. Requires 3" Clearance from any insulation on all sides, 1/2" clearance from building members
2. Where no minimum install height indicated, minimum height is the trim or J box height (whichever is greater) plus 1/2"
3. Hanger bars install on all 4 sides, expand from 13.5" to 24", accept FB bars, C-Channel, and 1/2" conduit for mounting
4. For non-dimming use dimming driver with standard switch
5. Maximum ceiling thickness 5/8"
6. E = emergency. Minimum plenum height 13"
7. For housings offered with Lutron EcoSystem and Lutron Forward Phase drivers, dimming is 100- 1%. Detailed information available on request.

TYPE

Project name: _____

Contact: _____ Date: _____

Remodeler Box Big

Code	Dimming	Max Power (DVR)	AC Input	Line current	Power factor	Minimum install height
T.RBL09.0000	Lutron Fwd Phase	40W	120VAC	0.40A	0.9	-

Notes

1. Requires 1/2" clearance from building members, 3" clearance from any insulation
2. Where no minimum install height indicated, minimum height is the trim height plus 1/2"
3. For non-dimming use dimming driver with standard switch
4. May be used with Non Electrical Housing for new construction
5. For housings offered with Lutron EcoSystem and Lutron Forward Phase drivers, dimming is 100- 1%. Detailed information available on request.

Remodeler Box Medium

Code	Dimming	Max Power (DVR)	AC Input	Line current	Power factor	Minimum install height
T.RMH60.0000	Phase Cut Dimming	37.3W	120VAC	0.34A	0.9	-
V.RMR01.0000	0/10V Dimming	29.4W	120VAC	0.28A	0.9	-
V.RMR01.0000.M	0/10V Dimming	29.4W	277VAC	0.12A	0.9	-

Notes

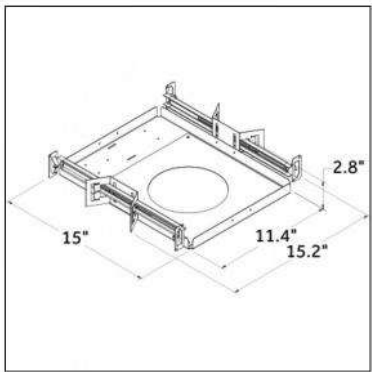
1. Requires 1/2" clearance from building members, 3" clearance from any insulation
2. Where no minimum install height indicated, minimum height is the trim height plus 1/2"
3. For non-dimming use dimming driver with standard switch
4. May be used with Non Electrical Housing for new construction
5. For housings offered with Lutron EcoSystem and Lutron Forward Phase drivers, dimming is 100- 1%. Detailed information available on request.

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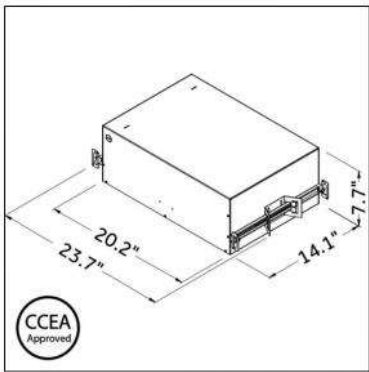
3 / 5

Housing



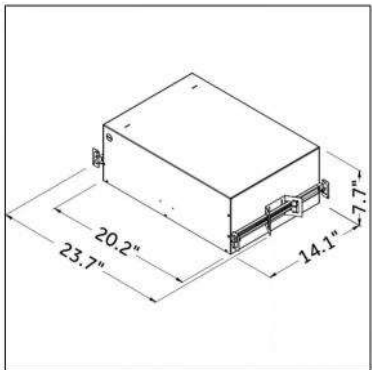
Non Electrical Housing

A.OMNEH.162C



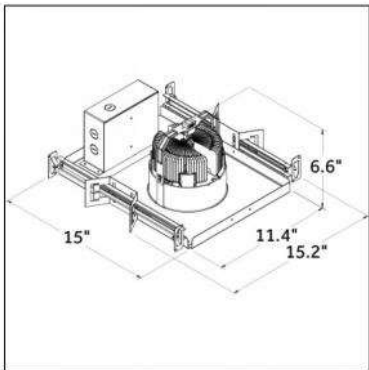
IC/Air Tight Housing

T.ALH60.162C
T.ALL09.162C
V.ALR02.162C



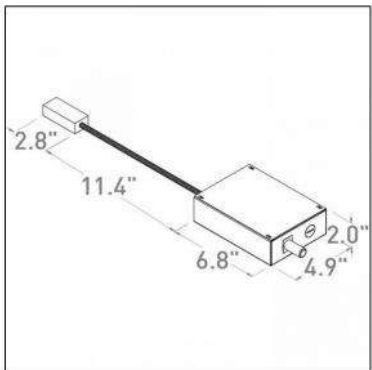
IC Housing

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T.I LL09.162C
V.I LR02.162C



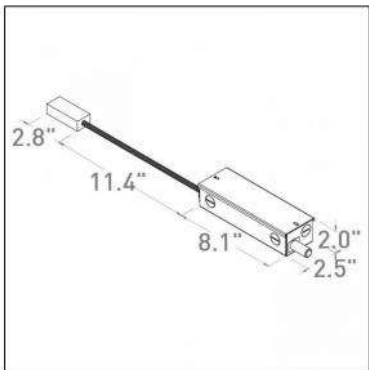
Non IC Open Housing

T.OMH60.162C
T.OMH60.162C.E
T.OML09.162C
T.OML09.162C.E
V.OMR01.162C
V.OMR01.162C.E
V.OMR01.162C.M
V.OMR01.162C.ME



Remodeler Box Big

T.RBL09.0000



Remodeler Box Medium

T.RMH60.0000
V.RMR01.0000
V.RMR01.0000.M


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www.reggianiusa.com

TYPE

Project name: _____
Contact: _____ Date: _____

Accessories

Image	Details	Note	Accessories ref.	Finish reference	Possible configuration
	Plastic Spacer Set		1.37824.00	00	1.37824.0000

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Non Electrical Housing

Code	Dimming	Max Power (DVR)	AC input	Line current	Power factor	Minimum install height
A.OMNEH.162C	N/A	-	VAC	-	-	-

Notes

1. Requires 1/2" clearance from building members, 3" clearance from any insulation
2. Refer to remodel housing for minimum install height
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5. Non electrical housings allow fixture positioning for post ceiling installation of remodel housing

IC/Air Tight Housing

Code	Dimming	Max Power (DVR)	AC input	Line current	Power factor	Minimum install height
T.ALH60.162C	Phase Cut Dimming	37.3W	120VAC	0.34A	0.9	-
T.ALL09.162C	Lutron Fwd Phase	40W	120VAC	0.40A	0.99	-
V.ALRO2.162C	0/10V Dimming	39.4W	120/277VAC	0.32/0.14A	0.8	-

Notes

1. Requires 1/2" clearance from building members
2. Hanger bars expand from 13.5" to 24", add 3.75" to the basic dimension of the housing
3. Hanger brackets accept FB bars, C-Channel, and 1/2" conduit for mounting
4. For non-dimming, use phase cut driver with standard switch
5. IC/AT housings are CCEA - Chicago Plenum approved
6. For housings offered with Lutron EcoSystem and Forward Phase drivers, dimming is 100- 1%. Detailed information available on request.

IC Housing

Code	Dimming	Max Power (DVR)	AC input	Line current	Power factor	Minimum install height
T.I.LH60.162C	Phase Cut Dimming	37.3W	120VAC	0.34A	0.9	-
T.I.LL09.162C	Lutron Fwd Phase	40W	120VAC	0.40A	0.99	-
V.I.LR02.162C	0/10V Dimming	39.4W	120/277VAC	0.32/0.14A	0.8	-

Notes

1. Requires 1/2" clearance from building members
2. Hanger bars expand from 13.5" to 24", add 3.75" to the basic dimension of the housing
3. Hanger brackets accept FB bars, C-Channel, and 1/2" conduit for mounting
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5. For housings offered with Lutron EcoSystem and Lutron Forward Phase drivers, dimming is 100- 1%. Detailed information available on request.

Non IC Open Housing

Code	Dimming	Max Power (DVR)	AC input	Line current	Power factor	Minimum install height
T.OMH60.162C	Phase Cut Dimming	37.3W	120VAC	0.34A	0.9	-
T.OMH60.162C.E	Phase Cut Dimming	37.3W	120VAC	0.34A	0.9	-
T.OML09.162C	Lutron Fwd Phase	40W	120VAC	0.40A	0.9	-
T.OML09.162C.E	Lutron Fwd Phase	40W	120VAC	0.40A	0.9	-
V.OMR01.162C	0/10V Dimming	29.4W	120VAC	0.284A	0.9	-
V.OMR01.162C.E	0/10V Dimming	29.4W	120VAC	0.284A	0.9	-
V.OMR01.162C.M	0/10V Dimming	29.4W	277VAC	0.123A	0.9	-
V.OMR01.162C.ME	0/10V Dimming	29.4W	277VAC	0.123A	0.9	-

Notes

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3. Hanger bars install on all 4 sides, expand from 13.5" to 24", accept FB bars, C-Channel, and 1/2" conduit for mounting
4. For non-dimming use dimming driver with standard switch
5. Maximum ceiling thickness 5/8"
6. E = emergency. Minimum plenum height 13"
7. For housings offered with Lutron EcoSystem and Lutron Forward Phase drivers, dimming is 100- 1%. Detailed information available on request.

Remodeler Box Big

Code	Dimming	Max Power (DVR)	AC Input	Line current	Power factor	Minimum install height
T.RBL09.0000	Lutron Fwd Phase	40W	120VAC	0.40A	0.9	-

Notes

1. Requires 1/2" clearance from building members, 3" clearance from any insulation
2. Where no minimum install height indicated, minimum height is the trim height plus 1/2"
3. For non-dimming use dimming driver with standard switch
4. May be used with Non Electrical Housing for new construction
5. For housings offered with Lutron EcoSystem and Lutron Forward Phase drivers, dimming is 100- 1%. Detailed information available on request.

Remodeler Box Medium

Code	Dimming	Max Power (DVR)	AC Input	Line current	Power factor	Minimum install height
T.RMH60.0000	Phase Cut Dimming	37.3W	120VAC	0.34A	0.9	-
V.RMR01.0000	0/10V Dimming	29.4W	120VAC	0.28A	0.9	-
V.RMR01.0000.M	0/10V Dimming	29.4W	277VAC	0.12A	0.9	-

Notes

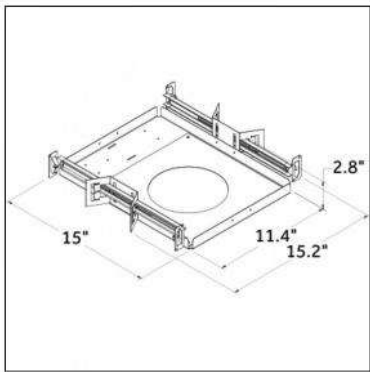
1. Requires 1/2" clearance from building members, 3" clearance from any insulation
2. Where no minimum install height indicated, minimum height is the trim height plus 1/2"
3. For non-dimming use dimming driver with standard switch
4. May be used with Non Electrical Housing for new construction
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TYPE

Project name: _____

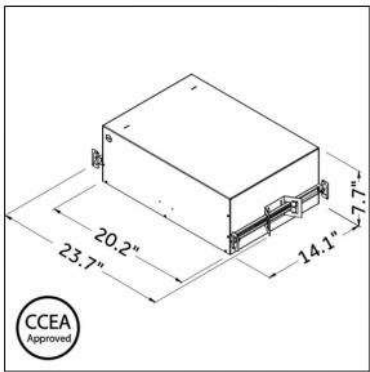
Contact: _____ Date: _____

Housing



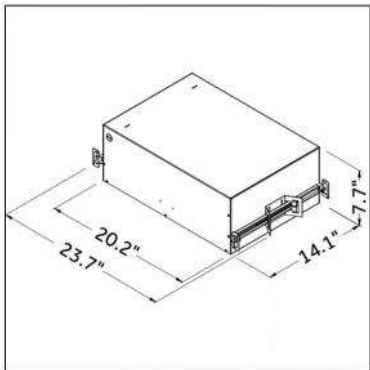
Non Electrical Housing

A.OMNEH.162C



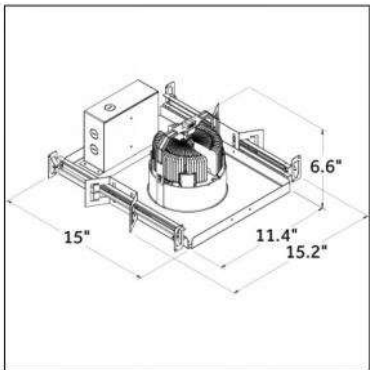
IC/Air Tight Housing

T.ALH60.162C
T.ALL09.162C
V.ALR02.162C



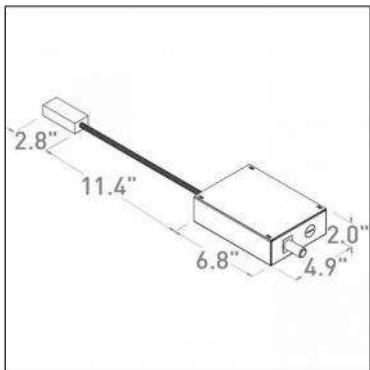
IC Housing

T.I LH60.162C
T.I LL09.162C
V.I LR02.162C



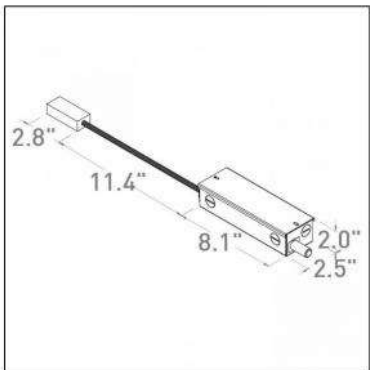
Non IC Open Housing

T.OMH60.162C
T.OMH60.162C.E
T.OML09.162C
T.OML09.162C.E
V.OMR01.162C
V.OMR01.162C.E
V.OMR01.162C.M
V.OMR01.162C.ME



Remodeler Box Big

T.RBL09.0000



Remodeler Box Medium

T.RMH60.0000
V.RMR01.0000
V.RMR01.0000.M


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TYPE

Project name: _____
Contact: _____ Date: _____

Accessories

Image	Details	Note	Accessories ref.	Finish reference	Possible configuration
	Plastic Spacer Set		1.37824.00	00	1.37824.0000

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5 / 5

SEE FIXTURE SCHEDULE FOR CATALOG NUMBER AND DESCRIPTION

Type: TQ-1
Sheet: 5 of 5



VC-Grid 15

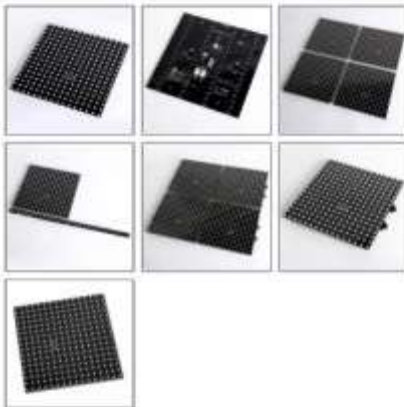
The VC-Grid 15 is a small, 240 x 240 mm LED video module with a 15 mm pixel pitch. Useful in creating customized LED video solutions with maximum artistic flexibility and a minimum of effort, the VC-Grid's compact size makes it extremely suitable for integration into stage designs, set elements, creative ceilings, lobbies and much more. Used with or without a front diffuser, multiple VC-Grids can be combined in a countless variety of ways for ultimate design freedom. A combined power/data cable allows VC-Grids to be daisy-chained for easy setup and less cabling

Wide range of pixel pitches to suit every application

Easy cabling, mapping and configuration

Bright and fully calibrated for optimal consistency

GALLERY



FEATURES

- 256 individually controllable pixels
- 5000 nits of brightness
- High-quality 16-bit per color image processing technology
- Pixel-level brightness and color calibration for optimal image quality
- P3/DMX controllable (automatic protocol detection)
- Intuitive mapping and addressing via P3 System Controller
- Combined power/data input (single cable for power and data input)
- Combined power/data thru (to daisy-chain multiple VC-Grids)
- Supported by integrated power and data processor (P3 PowerPort 1500) and simple cabling system
- Custom designs available on request (pixel pitch and module dimensions)

TECHNICAL SPECIFICATIONS

Physical

Length: 240 mm (9.5 in.) *
Width: 240 mm (9.5 in.) *
Height: 15 mm (0.6 in.)
Weight: 311 g (0.7 lbs.)
*Including 5 mm (0.2 in.) board-to-board gap

Control and Programming

Control options: Martin P3 System Controller™ via Martin P3 PowerPort 1500™ and/or DMX

Protocol detection: Automatic

Control modes: Calibrated and raw, pixel and module

DMX channels: 192 (segment mode) or 3 (module mode)

Setting and addressing: P3 System Controller or RDM-compliant controller

Control resolution: 16-bit (P3) or 8-bit (DMX) control of each color

Color and intensity calibration: Pixel-level

DMX compliance: USITT DMX512-A

RDM compliance: ANSI/ESTA E1.20

Firmware update: Via P3 System Controller

Control/User Interface

Device status: Multi-color visual indication

Device test and reset: Pushbutton to call up local test patterns and reset device

Optics

Minimum LED lifetime: 50 000 hours (to >70% luminous output)*

*Figure obtained under manufacturer's test conditions

Photometric Data



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Images contained in this brochure have been converted to CMYK and are not necessarily representative of actual colors. Specifications are subject to change without notice.

SEE FIXTURE SCHEDULE FOR CATALOG NUMBER AND DESCRIPTION

Type: TR
Sheet: 1 of 2

North Waterfront Park

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Pixels per module: 256
 Luminous intensity, calibrated mode: 5000 Nit
 Luminous intensity, raw mode: 6000 Nit
 Viewing angle: 120° x 120°
 Preliminary data, figures are approximate:

Video Processing

Brightness control
 Gamma correction and control
 Color temperature control
 Color gamut control
 Calibration processing
 Synchronization

Construction

Base: Black FR4 circuit board
 Transparency through module (unmasked area): 0%
 Protection rating: IP20
 RoHS compliant

Installation

Orientation: Any
 Maximum number of VC-Grid™ 16x16 15 modules per daisy-chain: 4
 Mounting: Mounting holes in module

Connections

Power & data input: 4-pin Molex connector
 Power & data thru: 4-pin Molex connector

Electrical

Nominal input voltage: 48 VDC from Martin P3 PowerPort 1500™ or external PSU
 Peak power consumption (at full intensity, full white): 60 W
 Typical power consumption (with typical video content): 20 W
 Figures for typical video content are indicative only and will vary:

Thermal

Cooling: Convection
 Maximum ambient temperature (Ta max.): 45° C
 Minimum ambient temperature (Ta min.): -20° C
 Peak heat dissipation (calculated, at full intensity, full white): 205 BTU/hr.
 Typical heat dissipation (calculated, with typical video content): 70 BTU/hr.
 Figures for typical video content are indicative only and will vary:

Approvals

EU safety: EN 60950
 EU EMC: EN 55022, EN 55024, EN 61000-3-2, EN 61000-3-3
 US safety: ANSI/UL 60950-1
 Canadian safety: CSA C22.2 No. 60950-1

Accessories

VC-Grid 15/30/60 Mounting Frames, set of 10: P/N 91611560
 Power+Data Cable Rental, 100 m (328.1 ft.): P/N 91616045
 Power+Data Cable Install CMX, 100 m (328.1 ft.): P/N 91616060

Input cables:

Power+Data Adapter XLR4-PCB, 0.25 m (0.9 ft.): P/N 91616035
 Power+Data Adapter XLR5+Power-XLR4, 0.25 m (0.9 ft.): P/N 91616037
 Power+Data Adapter XLR5+XLR4-XLR4, 0.25 m (0.9 ft.): P/N 91616038
 Power+Data Adapter XLR5+Tripi-XLR4, 0.25 m (0.9 ft.): P/N 91616039

VC-Grid to VC-Grid link cables:

Power+Data Cable PCB-PCB, 200 mm (7.9 in.): P/N 91616025
 Power+Data Cable PCB-PCB, 400 mm (15.8 in.): P/N 91616026
 Power+Data Cable PCB-PCB, 600 mm (23.7 in.): P/N 91616027
 Power+Data Cable PCB-PCB, 800 mm (31.5 in.): P/N 91616028
 Power+Data Cable PCB-PCB, 1000 mm (39.4 in.): P/N 91616029

Extension cables:

Power+Data Cable XLR4-XLR4, 1 m (0.9 ft.): P/N 91616030
 Power+Data Cable XLR4-XLR4, 2.5 m (8.2 ft.): P/N 91616031
 Power+Data Cable XLR4-XLR4, 5 m (16.4 ft.): P/N 91616032
 Power+Data Cable XLR4-XLR4, 10 m (32.8 ft.): P/N 91616033
 Power+Data Cable XLR4-XLR4, 25 m (82.1 ft.): P/N 91616034

Output/throughput cables:

Power+Data Adapter PCB-XLR4, 0.25 m (0.9 ft.): P/N 91616036
 Power+Data Adapter XLR4-XLR5, 0.25 m (0.9 ft.): P/N 91616040
 Hybrid cables carry both power and data:

Related Items

Martin P3 PowerPort 1500™: P/N 90721040
 Martin P3-050™ System Controller: P/N 90721090
 Martin P3-100™ System Controller: P/N 90721010
 Martin P3-150™ System Controller: P/N 90721015
 Martin P3-200™ System Controller: P/N 90721020
 Martin P3-300™ System Controller: P/N 90721060
 Martin P3-PC™ System Controller: P/N 90721030
 Martin™ IP66 PSU 240 W external power supply unit: P/N 90760330

Ordering Information

VC-Grid™ 16x16 15 RGB: P/N 90357540



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SEE FIXTURE SCHEDULE FOR CATALOG NUMBER AND DESCRIPTION

Type: TR
 Sheet: 2 of 2

North Waterfront Park

11/26/2019 10:58:07 AM

FRAXION4®

F4RTWW TRIMLESS

RECESSED LED DOWNLIGHT (IC, NON-IC, CHICAGO PLENUM & AIRTIGHT)
WALLWASHER 4" ROUND TRIMLESS
CEILING THICKNESS 1/2"-1 1/4"

Angled 4" aperture LED downlight with integrated appliqué for flush trimless appearance. Available in 80+, 90+, 97+ CRI, Warm Dim & Tunable White, with delivered lumen range of 452lm to 1,512lm. Lucifer Lighting developed proprietary wallwash optic. Dry / Damp and Wet location.

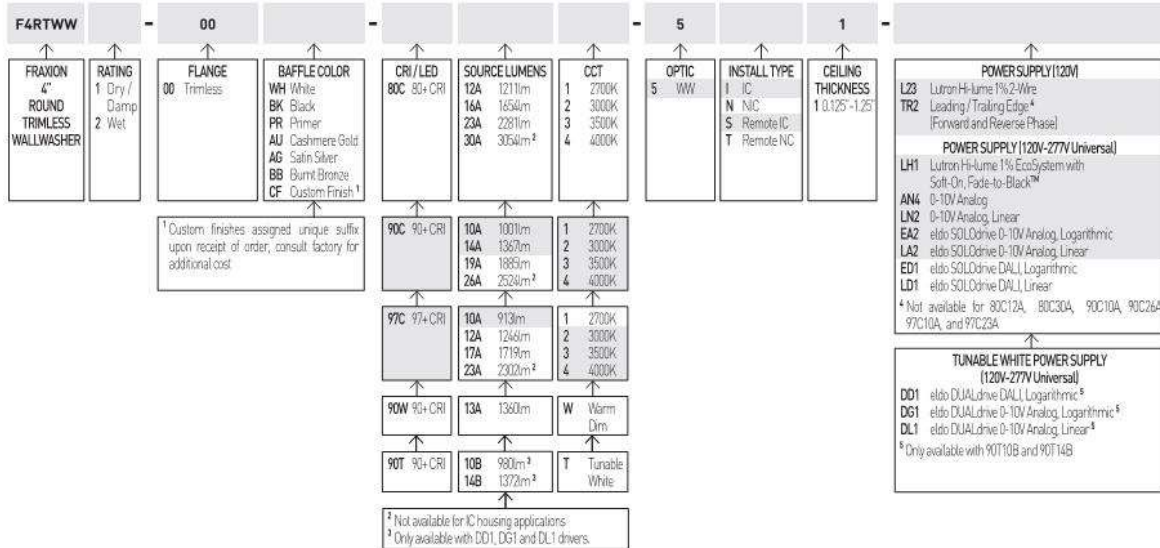


PERFORMANCE

80+ CRI (WW Optic)				90+ CRI (WW Optic)				97+ CRI (WW Optic)				WARM DIM 90+ CRI (40° Optic)			
LED Configuration	Delivered Lumens lm	Power Consumption W	Luminous Efficacy lm/W	LED Configuration	Delivered Lumens lm	Power Consumption W	Luminous Efficacy lm/W	LED Configuration	Delivered Lumens lm	Power Consumption W	Luminous Efficacy lm/W	LED Configuration	Delivered Lumens lm	Power Consumption W	Luminous Efficacy lm/W
80C12A	599	10	59	90C10A	495	10	49	97C10A	452	10	45	90W13A	658	47	14
80C16A	819	14	57	90C14A	677	14	47	97C12A	617	14	43	TUNABLE WHITE 90+ CRI (40° Optic)			
80C23A	1129	21	53	90C19A	933	21	44	97C17A	851	21	40	90T10B	590	14	42
80C30A	1512	31	48	90C26A	1249	31	40	97C23A	1139	31	37	90T14B	807	18	44

ORDERING INFORMATION - DOWNLIGHT

24 JA8-2016 INDICATED BY SHADING



HOUSING



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pg. 1

SEE FIXTURE SCHEDULE FOR CATALOG NUMBER AND DESCRIPTION

Type: TW
Sheet: 1 of 4

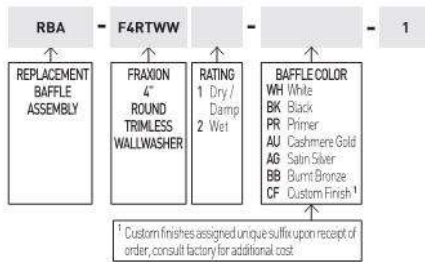
North Waterfront Park

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FRAXION4® F4RTWW TRIMLESS

ACCESSORIES

REPLACEMENT EFFECTS DEVICE (INCLUDES EFFECTS DEVICE)



REPLACEMENT OPTIC

☐ RO-70-WW-1 WW optic

TUNABLE WHITE REPLACEMENT OPTIC

☐ RO-70-WW-2 WW optic

EMERGENCY LIGHTING - REMOTE MOUNT ONLY

- ☐ EMB-S-20/25-120/277-LEDX 20/25 watt max capacity, 120 or 277 VAC 60Hz
- ☐ EMB-S-100-120-LEDX 100 watt max capacity, 120 VAC 60Hz
- ☐ EMB-S-100-277-LEDX 100 watt max capacity, 277 VAC 60Hz
- ☐ EMB-S-250-120/277-LEDX 250 watt max capacity, 120 or 277 VAC 60Hz

During disruption of main power, emergency inverter provides temporary 120V or 277V to fixture.

TECHNICAL

CONSTRUCTION

Downlight: Aluminum and steel. Extruded aluminum heat-sink. Painted finishes are granulated powder coat.

Housing: 22 Gauge galvanized steel.

Remote Power Supply: 22 Gauge galvanized steel.

Applique: Zinc alloy.

LED

Proprietary Citizen 2 step MacAdam ellipse LED module available in 80+, 90+ and 97+ CRI configurations in color temperatures of 2700K, 3000K, 3500K and 4000K. Average rated lamp life: 50,000 hours. LED and driver assemblies are field-replaceable.

WARM DIM LED

Proprietary 3 step MacAdam ellipse warm dim LED module available in 90+ CRI configuration. 3200K at full brightness, warming to 1800K at full dim. Average rated lamp life of 50,000 hours. LED and driver assemblies are field-replaceable.

TUNABLE WHITE LED

Proprietary 5 step MacAdam ellipse tunable white LED module available in 90+ CRI configuration. Features tuning range of 2700K to 5000K. Average rated lamp life: 50,000 hours. LED and driver assemblies are field-replaceable.

POWER SUPPLY PERFORMANCE AND DIMMING INFORMATION

	ELV		ECO		0-10V						DALI		
Power Supply	TR2	L23	LH1	AN4	LN2	EA2	LA2	DL1	DG1	ED1	LD1	DD1	
Minimum °C	-20 °C	0 °C	0 °C	-20 °C	-20 °C	-20 °C	-20 °C	-20 °C	-20 °C	-20 °C	-20 °C	-20 °C	
Maximum °C	40 °C	40 °C	40 °C	40 °C	40 °C	40 °C	40 °C	40 °C	40 °C	40 °C	40 °C	40 °C	
Dimming %	2.0%	1.0%	1.0%	1.0%	1.0%	0.1%	0.1%	0.1%	0.1%	0.1%	0.1%	0.0%	

Note: For EA2, LA2 and L23 drivers consult chart on page 4 to confirm appropriate dimming curve for compatibility with selected control.

SPACING

Recommended fixture spacing is 36" (914mm) on center with 36" (914mm) setback from wall plane.

LISTING

cTUVus listed to UL1598 standard for Dry / Damp and Wet locations. Chicago Plenum, Airtight and Title 24 JA8-2016 Listed. Patent pending.

WARRANTY

Manufacturer's 1-year warranty guarantees product(s) listed to be free from defects in material and workmanship under normal use and service. 5-year warranty on LED and power supply to operate with 70% of the original flux and remain within a range of 3 duv. 10-year Lutron Advantage limited warranty available on Lutron equipped systems. Warranty period begins from the date of shipment by Seller and conditional upon the use of manufacturer-supplied power supply. Consult website for full warranty terms and conditions.

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Type: TW
Sheet: 2 of 4

North Waterfront Park

11/26/2019 10:58:07 AM

FRAXION4® F4RTWW TRIMLESS

DOWNLIGHT

A BAFFLE

Die-cast baffle minimizes aperture glare and conceals view into housing; includes silicone gasket.

B RETENTION

Integrated metal arm clamps located within fixture body allow discreet flange design, while accommodating varying ceiling thicknesses from 0.50" (13mm) to 1.25" (32mm).

C OPTIC

Proprietary wallwash optic design integrates Reflection, Refraction and TIR principles.

D EFFECTS DEVICES

Asymmetrical spread lens, included and sealed in place, combined with angled optic and wide aperture enhance uniformity.

E TRIMLESS PROFILE

Installs totally flush with the ceiling with no visible trim. Features integrated appliqué for plaster floating directly to the baffle. Not recommended for stucco applications.

HOUSING / MOUNTING

F ICT (IC) HOUSING - TALL

- For IC ceilings.
- Chicago Plenum, Airtight and Title 24 (JA8) listed.
- Accommodates max 1129 delivered lumens.
- No setback from polycell spray foam insulation having max R-Value of 60 on all sides and top of housing.

G NCM (NIC) HOUSING - MEDIUM

- Minimum 0.50" (13mm) setback from combustible and non-combustible materials on all sides and top of housing.
- Minimum 3.00" (76mm) setback from insulation material having max R-Value 30 on all sides and top of housing.
- Minimum 6.00" (152mm) setback from polycell spray foam insulation having max R-Value 60.

H HOUSING COLLAR

- Requires 4.625" (117mm) diameter cutout.
- Fixed round aperture housing collar.
- Accommodates varying ceiling thicknesses.

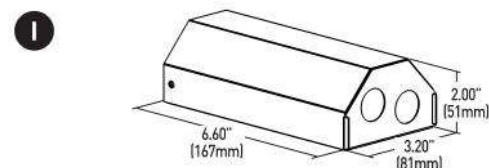
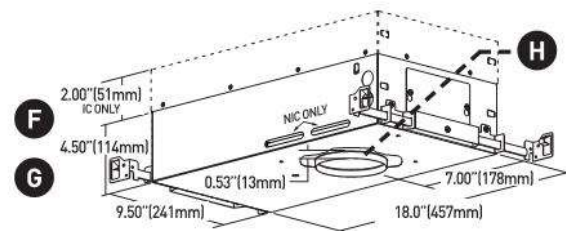
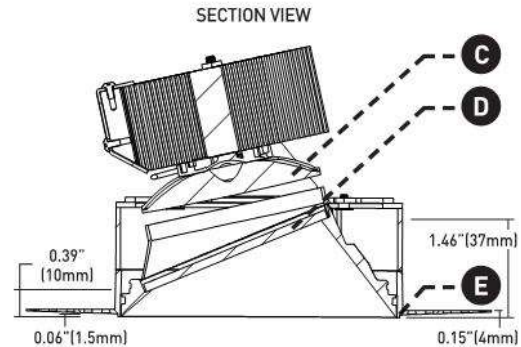
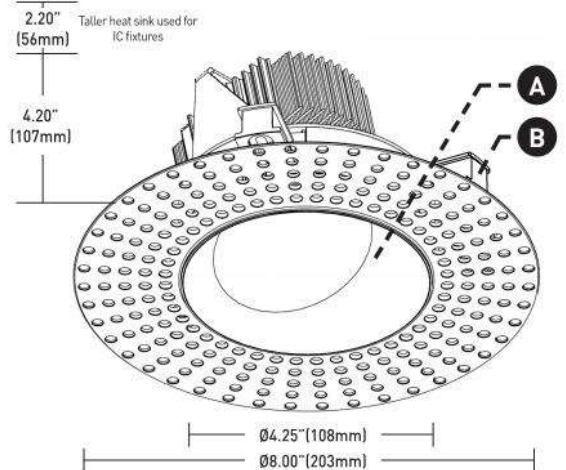
HOUSING / MOUNTING NOTES

- Do not install in environments where ambient temperatures exceed 40°C (104°F).
- Power supply compartment and all splice connections may be serviced from room side.
- Consult factory for spacing requirements for any installations exceeding R-Value 60.
- Hanger bars fitted to short side of housing, extend from 14.0" to 24.0", but may be field cut to accommodate narrow stud spacing.
- Hanger bars and brackets add 4.00" to the overall dimension, but are exclusive of the setback requirements.
- Driver assembly ships with trim, not housing. Housing and trim feature mating quick-connect plugs for ease of installation.

REMOTE POWER SUPPLY

- Provided with install types "S" and "T".

DIMENSIONS / DRAWINGS



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pg. 3

SEE FIXTURE SCHEDULE FOR CATALOG NUMBER AND DESCRIPTION

Type: TW
Sheet: 3 of 4

North Waterfront Park

11/26/2019 10:58:07 AM

FRAXION4® F4RTWW TRIMLESS

DIMMING COMPATIBILITY

eldoLED DRIVER COMPATIBILITY

Power supply EA2, LA2 Dimmer / Switch Control Manufacturer	Family/Model #	Recommended Curve
Busch-Jaeger	2112U-101	Logarithmic
Jung	240-10	Logarithmic
Leviton Lighting Controls	IP710-DLX	Logarithmic
Lightolier Controls	ZP600FAM120	Logarithmic
Lutron Electronics	Nova T® - NTFTV	Linear
Lutron Electronics	Diva® - DDTV	Linear
Lutron Electronics	Nova® - NDTV	Linear
Merten	5729	Logarithmic
Pass & Seymour	CD4FB-W	Logarithmic
The Watt Stopper	DCLV1	Logarithmic
Sensor Switch	nIO EZ	Linear
Synergy	ISD BC	Logarithmic
Lighting Control Systems		
Lutron Electronics	GrafixEye® GRX-TVI w GRX3503	Linear
Lutron Electronics	Energy Savr Node™ - QSN-4T16-S	Linear
Lutron Electronics	TVM2 Module	Linear
Creston®	GLX-DIMFLV8	Logarithmic
Creston®	GLXP-DIMFLV8	Logarithmic
Creston®	GLPAC-DIMFLV4-*	Logarithmic
Creston®	GLPAC-DIMFLV8-*	Logarithmic
Creston®	GLPP-DIMFLVEX-PM	Logarithmic
Creston®	GLPP-1DIMFLV2EX-PM	Logarithmic
Creston®	GLPP-1DIMFLV3EX-PM	Logarithmic
Creston®	DIN-A08	Logarithmic
Creston®	DIN-4DIMFLV4	Logarithmic
Creston®	CLS-EXP-DIMFLV	Logarithmic
Creston®	CLCI-1DIMFLV2EX	Logarithmic
ABB	SD/S 2.16.1	Logarithmic

LUTRON DRIVER COMPATIBILITY

Power supply L23 Product Family	Part No.	Fixtures Per Control (120V only)
Maestro WirelessR 600 W dimmer	MRF2-6ND-120-	1-8
Maestro WirelessR 1000 W dimmer	MRF2-10ND-120-	1-13
Caséta® Wireless Pro 1000 W dimmer	PD-10NXD-	1-13
GRAFIK T™ CL® dimmer	GT-250M-, GTJ-250M-	1-10
HomeWorks® QS adaptive dimmer	HQRD-6NA-	1-8
HomeWorks® QS 600 W dimmer	HQRD-6ND-	1-8
HomeWorks® QS 1000 W dimmer	HQRD-10ND-	1-13
RadioRA® 2 adaptive dimmer	RRD-6NA-	1-8
RadioRA® 2 1000 W dimmer	RRD-10ND-	1-13
myRoom™ DIN power module	MQSE-4A1-D	1-6 (per output), 1A max driver input current
HomeWorks® QS DIN power module	LQSE-4A1-D	1-6 (per output), 1A max driver input current
HomeWorks® QS wallbox power module	HQRJ-WPM-6D-120	2-10 (per output), 26 total per module
HomeWorks® wallbox power module	HWI-WPM-6D-120	2-10 (per output), 26 total per module
GRAFIK Eye® QS control unit	QSGR-, QSGRJ-	2-10 (per output), 26 total per module
GRAFIK Eye® 3000 control unit	GRX-3100-, GRX-3500-	2-10 (per output), 26 total per module
RPM-4U module (LCP, HomeWorks® QS, GRAFIK Systems™, Quantum®)	HW-RPM-4U-120, LP-RPM-4U-120	2-26 (per output), 26 total per module
RPM-4A module (LCP, HomeWorks® QS, GRAFIK Systems™, Quantum®)	HW-RPM-4A-120, LP-RPM-4A-120	1-13 (per output), 26 total per module
GP dimming panels	Various	1-26
Ariadni CL 250W dimmer	AYCL-253P-	1-8
Diva CL 250W dimmer	DVCL-253P-, DCSCCL-253P-	1-8
Nova T CL 250W dimmer	NTCL-250-	1-10



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pg. 4

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Type: TW
Sheet: 4 of 4

North Waterfront Park

11/26/2019 10:58:07 AM

LED Ceiling-mounted downlights - narrow beam

Housing: One piece die-cast aluminum for direct attachment to a 3 1/2" or 4" recessed octagonal wiring box using a mounting strap. Die castings are marine grade, copper free (≤ 0.3% copper content) A360.0 aluminum alloy.

Enclosure: Tempered clear glass, retained by a one piece, die-cast aluminum frame. Frame is secured by threading into luminaire housing. Fully gasketed for weather tight operation using a molded silicone rubber gasket.

Electrical: 26W LED luminaire, 31 total system watts, -30°C start temperature. Integral 120V through 277V electronic LED driver, 0-10V dimming. LED module(s) are available from factory for easy replacement. Standard LED color temperature is 3000K with an >80 CRI. Available in 4000K (>80 CRI); add suffix K4 to order.

Note: LEDs supplied with luminaire. Due to the dynamic nature of LED technology, LED luminaire data on this sheet is subject to change at the discretion of BEGA-US. For the most current technical data, please refer to www.bega-us.com.

Finish: All BEGA standard finishes are polyester powder coat with minimum 3 mil thickness. Available in four standard BEGA colors: Black (BLK); White (WHT); Bronze (BRZ); Silver (SLV). To specify, add appropriate suffix to catalog number. Custom colors supplied on special order.

CSA certified to U.S. and Canadian standards, suitable for wet locations. Protection class IP65

Weight: 5.1 lbs.

Luminaire Lumens: 1805
Tested in accordance with LM-79-08

Type:
BEGA Product:
Project:
Voltage:
Color:
Options:
Modified:



	Lamp	β	A	B
66978	26W LED	21°	7 1/2"	6 1/8"

β = Beam angle

BEGA-US 1000 BEGA Way, Carpinteria, CA 93013 (805) 684-0533 FAX (805) 566-9474 www.bega-us.com
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SEE FIXTURE SCHEDULE FOR CATALOG NUMBER AND DESCRIPTION

Type: TX
Sheet: 1 of 1

North Waterfront Park

11/26/2019 10:58:07 AM

Application

LED recessed wall luminaire with asymmetrical light distribution for the illumination of ground surfaces, building entrances, stairs and footpaths.

Materials

Luminaire housing and faceplate constructed of die-cast aluminum marine grade, copper free (≤ 0.3% copper content) A360.0 aluminum alloy
Clear safety glass
Silicone applied robotically to casting, plasma treated for increased adhesion
High temperature silicone gasket
Mechanically captive stainless steel fasteners
Stainless steel screw clamps
Composite installation housing

NRTL listed to North American Standards, suitable for wet locations
Protection class IP65
Weight: 1.5 lbs

Electrical

Operating voltage 120-277V AC
Minimum start temperature -40°C
LED module wattage 4.1 W
System wattage 6.0 W
Controlability 0-10V dimmable
Color rendering index Ra > 80
Luminaire lumens 231 lumens (3000K)
Lifetime at Ta=15°C 428,000 h (L70)
Lifetime at Ta=25°C 229,000 h (L70)

LED color temperature

2700K - Product number + **K27**
3000K - Product number + **K3**
3500K - Product number + **K35**
4000K - Product number + **K4**

BEGA can supply you with suitable LED replacement modules for up to 20 years after the purchase of LED luminaires - see website for details

Finish

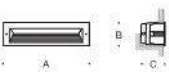
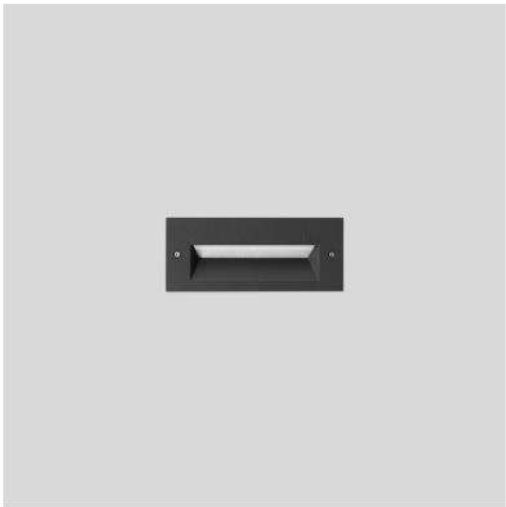
All BEGA standard finishes are matte, textured polyester powder coat with minimum 3 mil thickness.

Available colors Black (BLK) White (WHT) RAL:
 Bronze (BRZ) Silver (SLV) CUS:

Type:
BEGA Product:
Project:
Modified:



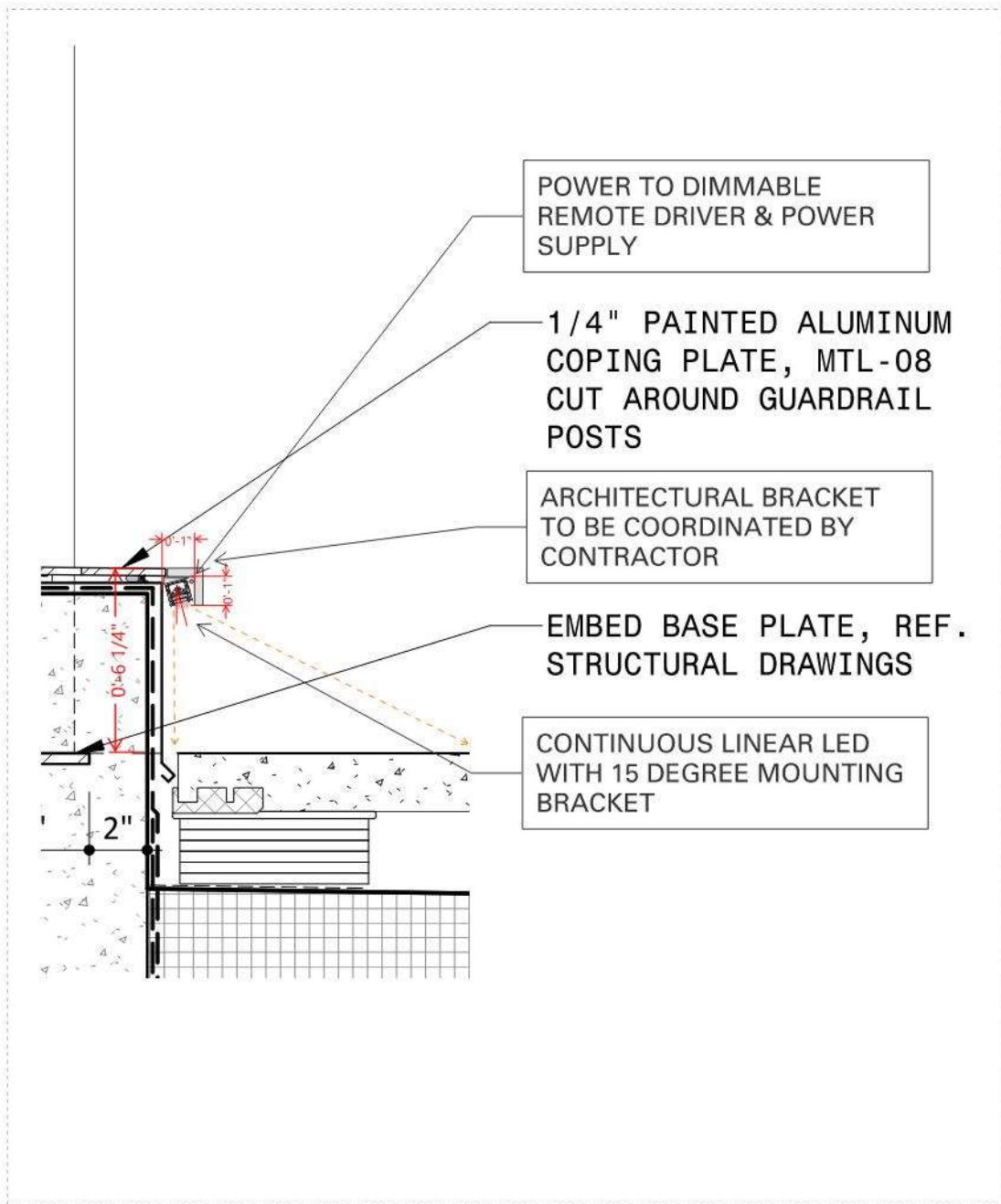
Fully enclosed luminaire with installation housing ensures seamless integration and weathertight operation.



LED recessed wall luminaires - asymmetrical				
	LED	A	B	C
33053	4.1 W	6 5/8"	2 3/4"	5"

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Due to the dynamic nature of lighting products and the associated technologies, luminaire data on this sheet is subject to change at the discretion of BEGA North America. For the most current technical data, please refer to bega-us.com
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TYPE TZ SKETCH DETAIL
Scale_NA

NORTHFRONT WATERPARK
2019.11.25

SEE FIXTURE SCHEDULE FOR CATALOG NUMBER AND DESCRIPTION

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Type:
Sheet:

TZ
1 of 5

VarioLED HD IP67 Static White/RGB

24 V outdoor rated linear LED strip delivered in custom lengths up to 13 ft (4m). Polyurethane encapsulation offers a premium water proof sealing, UV resistance, chemical



HD - High LED Density

stability and protection against abrasion. White lower casing for better light extraction thus higher efficacy. Delivered complete with IP67 mini connectors on both ends. Reel-to-Reel (R2R) produced flexible circuit board material with LED Linear™ TJ Away® technology for optimal heat management. Constant light output and extended lifetime thanks to an integrated circuit (IC) driver regulation. One Bin Only® top quality LEDs with 120° beam angle and excellent color rendering up to CR 95. 3 step MacAdam ellipse guarantees consistent color temperature and light quality at a life-time of >60,000 hrs L80/B10 and >30,000 for RGB. Extended 6 digit photometric code ensures color consistency over the rated lifetime. Fully dimmable. Engineered and manufactured in Germany.



Up to 785 lm/ft
147 lm/W constant
light output



High Quality
Solder Free Reels



Exceptional Thermal
Dissipation



3 MacAdam up to
95 CRI



L80/B10 >60,000 hrs
/RGB >30,000 hrs.



Wuxx/339



LM79 Compliant



LM80 Compliant

Project name _____

Fixture type _____ Phase _____

Specifier _____ Date _____



Static White



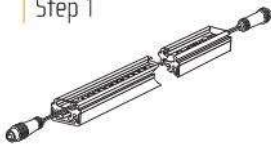
RGB



Intertek
ETL Listed

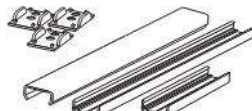
Ordering Process

Step 1



Luminaire Custom Length (Page 1)

Step 2



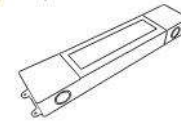
Mounting and Optical Accessories (Page 3)

Step 3



Cables and Connectors (Page 3)

Step 4



Drivers and Controllers (Page 4)

Luminaire Order Code

Family	Model	Lumen package*	Color rendering	Color temperature	Custom Length***	Ingress
VarioLED		HD__	W__			IP67
	HYDRA - Static White	HD06-142 lm/ft	W8-80CRI	20-2500K	L _{min} : 82 mm (3'-1/4")	
		HD10-237 lm/ft	W9-90CRI**	22-2900K		
		HD15-484 lm/ft		25-3300K	HD06/10/15 L _{max} : 4019 mm (13'-2-1/2")	
		HD25-785 lm/ft		27-3800K (3600K for W9)	HD25 L _{max} : 3019 mm (9'-11")	
				30-4300K (4300K for W9)		
				35-5100K (4900K for W9)	Increment: 62.5 mm (4'-15/16")	
	RGB	HD10-134 lm/ft	—	—		
		HD20-247 lm/ft	—	—		

* Lumen Values represent 5100K (W835) ** Available only for HD06 and HD10 *** Custom Length should be specified in millimeters (mm) / Maximum Length items ship with one male connector only.

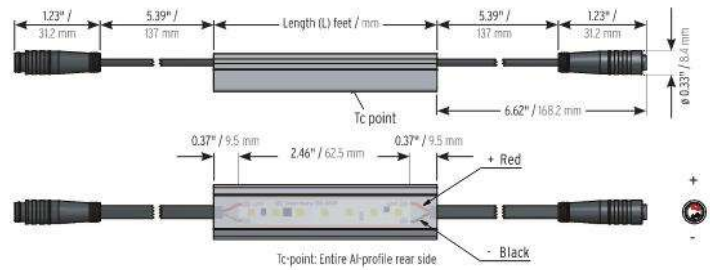
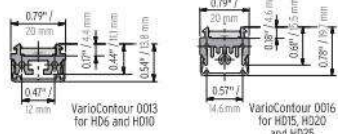
			HD6		HD10		HD15		HD20		HD25	
	Color temperature ¹	CCT (Delivered)	Lumen/ft	W/ft ⁴	Lumen/ft	W/ft ⁴	Lumen/ft	W/ft ⁴	Lumen/ft	W/ft ⁴	Lumen/ft	W/ft ⁴
Static White	W820	2,500 K	118	1.8	194	3.1	313	4.6	—	—	508	7.6
	W822	2,900 K	133	1.8	222	3.1	356	4.6	—	—	581	7.6
	W825	3,300 K	151	1.8	255	3.1	407	4.6	—	—	663	7.6
	W827/W927	3,800 K/3,600 K	136	1.8	228	3.1	432	4.6	—	—	703	7.6
	W830/W930	4,300 K/4,300 K	139	1.8	231	3.1	459	4.6	—	—	746	7.6
	W835/W935	5,100 K/4,900 K	142	1.8	237	3.1	484	4.6	—	—	785	7.6
RGB	RGB Red	622 nm	—	—	134	3.1	—	—	247	6.7	—	—
	RGB Green	532 nm	—	—	134	3.1	—	—	247	6.7	—	—
	RGB Blue	466 nm	—	—	134	3.1	—	—	247	6.7	—	—
	RGB total	—	—	—	—	—	—	—	—	—	—	—

¹ The given data are typical values. Due to tolerances of the production process and the electrical components, values for light output and electrical power can vary up to 10%.

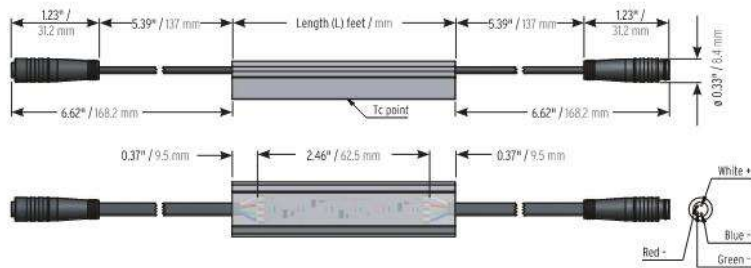
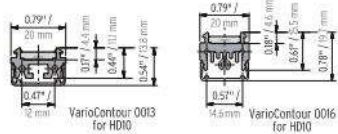
⁴ CCT tolerances occur in IP67 products due to the encapsulation of the fixture.

Mechanical Details - Static White

Static White



RGB



Technical Details

	Static White	RGB
Step length	7 LEDs per 2.46" / 125 mm	6 LEDs per 2.46" / 125 mm
Voltage	24 Volt (23 V _{min} , 25 V _{max})	24 Volt (23 V _{min} , 25 V _{max})
Case temperature ^a	T _{Cmin} = -13°F / -25°C, T _{Cmax} = 185°F / 85°C	T _{Cmin} = -13°F / -25°C, T _{Cmax} = up to 158°F / 70°C
Storage temperature	T _{Smin} = -22°F / -30°C, T _{Smax} = 185°F / 85°C	T _{Smin} = -22°F / -30°C, T _{Smax} = 158°F / 70°C
Ambient temperature	T _{Amin} = -13°F / -25°C, T _{Amax} = 122°F / 50°C	T _{Amin} = -13°F / -25°C, T _{Amax} = 113°F / 45°C

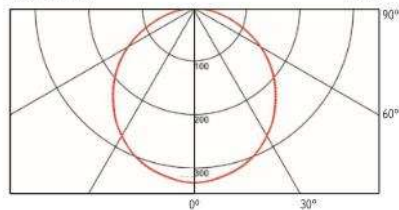
^a The position of the Tc-point is marked on each step of the LED strip. The Tc-point should be measured in thermal equilibrium according to IEC EN 60598-1.

	Static White HD6	Static White HD10	Static White HD15	Static White HD25	RGB HD10	RGB HD20
Power (W/ft) ^a	1.8	3.1	4.6	7.6	3.1	6.7
Efficacy (lm / W) ^a @ W850	110	138	147	144	44	37
CRI / R9 @ 3000 K	95 / 65	95 / 65	85 / 25	85 / 25	-	-
Reel length (ft / m)	16.4 / 5	16.4 / 5	13.1 / 4	9.8 / 3	13.1 / 4	13.1 / 4

^a The given data are typical values. Due to tolerances of the production process and the electrical components, values for light output and electrical power can vary up to 10%.

Light Distribution

Static White

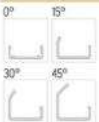





RGB

cd/1,000 lumen
C0/C180
C90/C270







Mounting Accessories

Item	Description	Dimensions (L x W x H)	Order Code
	Aluminum surface mounting bracket, recommended to use every 20 inches. Available in four different angles. 3.5 inches long.	3-1/2" x 3/4" x 1/4" 3-1/2" x 3/4" x 1/2" 3-1/2" x 3/4" x 3/4" 3-1/2" x 3/4" x 7/8"	10000040 10000040-15d 10000040-30d 10000040-45d
	Continuous aluminum surface mounting profile. 6.5 ft long.	6-1/2" x 3/4" x 1/4"	10000039
	White plastic surface mounting bracket. Recommended to use every 20 inches. Cannot be used together with the aluminum mounting profile.	3/4" x 1-1/4" x 1/4"	13000032
	Use to adjust and fix the angle of fixture. 180° adjusting range. Delivered as a pair with screws included. Only for VarioContour 0016.	1/8" x 3/4"	13000082

Optical Accessories

							
Round Opal 12000004	Linear Lens, Clear 30 12000020	Linear Lens, Clear 60 12000021	Linear Lens, Clear 90 12000022	Linear Lens, Diffuse 15 12000049	Linear Lens, Diffuse 30 12000029	Linear Lens, Diffuse 60 12000031	Linear Lens, Diffuse 90 12000032



Cables and Connectors

Item	Description	Model	Dimensions	Order Code
	Use to run cable from the driver to the first fixture of the run or to the next fixture. Female connector on one side and open end cable on the other side. Available with staright or 90° L-shaped connector.	Static White	2 x 22 Awg, 4 in	15000071
		Static White	2 x 22 Awg, 3.2 ft	15000090
		Static White	2 x 22 Awg, 6.5 ft	15000091
		Static White	2 x 22 Awg, 16.5 ft	15000092
		Static White / 90°	2 x 22 Awg, 6.5 ft	15000089
		RGB / Tunable White	4 x 23 Awg, 4 in	15000094
		RGB / Tunable White	4 x 23 Awg, 3.2 ft	15000095
		RGB / Tunable White	4 x 23 Awg, 6.5 ft	15000096
	Use to run cable from the fixture to the driver or to the previous fixture. Male connector on one side and open end cable on the other side.	Static White	2 x 22 Awg, 4 in	15000070
		Static White	2 x 22 Awg, 3.2 ft	15000093
		RGB / Tunable White	2 x 23 Awg, 4 in	15000099
		RGB / Tunable White	2 x 23 Awg, 3.2 ft	15000100
	Use to extend the distance between connection points. Female connector on one side and male connector on the other side.	Static White / RGB / Tunable White	4 x 23 Awg, 3 in	15000101
		Static White / RGB / Tunable White	4 x 23 Awg, 6.5 ft	15000102
		Static White / RGB / Tunable White	4 x 23 Awg, 16.5 ft	15000103
	Use to seal unused connectors and maintain IP67 ingress protection.	Static White / RGB / Tunable White	—	15000115

Drivers

Item	Specifications	Downloads
LED LINEAR™ Non-Dimmable Drivers 	<ul style="list-style-type: none"> • UL 8750 Listed Enclosure - With Built-In Junction Boxes • Universal Input Voltage 120V - 277V • IP65 - For Both Indoor and Outdoor Use • No Minimum Load Requirement • 24V Constant Voltage Output, Class 2 • Available in three wattages 30W, 60W and 96W • Max. Dimensions: 12-1/8" x 2-3/8" x 1-3/8" 	30' W SPEC SHEET 60' W SPEC SHEET 96' W SPEC SHEET INSTALLATION INSTRUCTIONS
LED LINEAR™ 0-10V Dimmable Drivers 	<ul style="list-style-type: none"> • UL 8750 Listed Enclosure - With Built-In Junction Boxes • 0-10V Dimmable - Flicker Free Down to 1% • Universal Input Voltage 120V - 277V • IP65 - For Both Indoor and Outdoor Use • 24V Constant Voltage Output, Class 2, Class P • Available in three wattages 30W, 60W and 96W • Max. Dimensions: 12-1/8" x 2-3/8" x 1-3/8" 	30' W SPEC SHEET 60' W SPEC SHEET 96' W SPEC SHEET INSTALLATION INSTRUCTIONS
LED LINEAR™ ELV/Triac Dimmable Drivers 	<ul style="list-style-type: none"> • UL 8750 Listed Class 2 Enclosure • 24V constant voltage output • Compact size yet high efficiency and performance in dry and damp environments (IP67) • Multiple Inputs: 120V or 277V • Fully dimmable: ELV Dimmers - Reverse or Adaptive Phase Control, Trailing Edge • Available in two wattages 48W and 96W • Multiple Circuits are available up to 4 units (up to 384W) 	48' W SPEC SHEET 96' W SPEC SHEET INSTALLATION INSTRUCTIONS
 PWM Dimmable Drivers 	<ul style="list-style-type: none"> • Universal AC input / Full range (up to 305VAC) • Constant voltage PWM style output • Built-in 3 in 1 dimming function (0-10Vdc or PWM signal or resistance) • Dimming range : 0-100% • Class 2 power unit • Suitable for dry / damp / wet locations • UL Recognized component, 5 years warranty 	40' W SPEC SHEET 60' W SPEC SHEET 90' W SPEC SHEET INSTALLATION INSTRUCTIONS
 Dimmable Drivers 	<ul style="list-style-type: none"> • UL Listed Enclosure • Dimming Range: 100% to 1% and 0.1% (Premiere) • LED lighting turns on to any dimmed level without flashing to full brightness • Operating Voltage: 120V~ to 277V~ at 50/60 Hz • Rated lifetime of 50,000 hours at 40°C (104°F) ambient temperature and maximum loading • For rated warranty, ambient temperature not to exceed 40°C (104°F) • Open-circuit protected output 	HI-LUME SPEC SHEET HI-LUME PREMIERE SPEC SHEET INSTALLATION INSTRUCTIONS
eldoLED DALI/DMX Dimmable Drivers 	<ul style="list-style-type: none"> • Available in linear or rectangular format • 100W, DMX/DALI interface • 4 control channels • 24V constant voltage, 4 x 24V outputs • Metal or plastic case options 	100' W SPEC SHEET INSTALLATION INSTRUCTIONS

Controllers

Item	Specifications	Downloads
 eldoLED Controllers 	180/D DMX Controller for RGB and Tunable White Applications 210/D Dali Controller for Static White, RGB and Tunable White Applications 211/D-LG 0-10V Logarithmic Dimming Controller 211/D-LN 0-10V Linear Dimming Controller 212/D DMX Controller for Static White and Static Color Applications DimWheel DMX Wall Controller for RGB and Tunable White Applications	180/D SPEC SHEET 210/D SPEC SHEET 211/D-LG SPEC SHEET 211/D-LN SPEC SHEET 212/D SPEC SHEET DIM WHEEL SPEC SHEET

Click for more information

PRODUCT BROCHURE

INSTALLATION

IES FILES

DRIVERS & CONTROLS

LED LINEAR TECHNOLOGY

SECTION 265119 – LED INTERIOR LIGHTING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section includes LED luminaires, materials, finishes, supports.
- B. Related Requirements:
 - 1. Section "Lighting Control Devices" for automatic control of lighting, including time switches, photoelectric relays, occupancy sensors, and multipole lighting contactors.

1.3 DEFINITIONS

- A. CCT: Correlated color temperature.
- B. CRI: Color Rendering Index.
- C. Fixture: See "Luminaire."
- D. IP: International Protection or Ingress Protection Rating.
- E. LED: Light-emitting diode.
- F. Lumen: Measured output of lamp and luminaire, or both.
- G. Luminaire: Complete lighting unit, including lamp, reflector, and housing.

1.4 ACTION SUBMITTALS

- A. Product Data: For each type of product.
 - 1. Arrange in order of luminaire designation.
 - 2. Include data on features, accessories, and finishes.
 - 3. Include physical description and dimensions of luminaires.
 - 4. Include emergency lighting units, including batteries, chargers, photometric performance data.
 - 5. Include life, output (lumens, CCT, and CRI), and energy efficiency data.

1.5 INFORMATIONAL SUBMITTALS

- A. Sample warranty.

- B. Seismic Qualification Certificates: For luminaires, accessories, and components, from manufacturer.
 - 1. Basis for Certification: Indicate whether withstand certification is based on actual test of assembled components or on calculation.
 - 2. Dimensioned Outline Drawings of Equipment Unit: Identify center of gravity and locate and describe mounting and anchorage provisions.

1.6 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: For luminaires and lighting systems to include in operation and maintenance manuals.

1.7 MAINTENANCE MATERIAL SUBMITTALS

- A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
 - 1. LED Drivers and Lamps: Ten for every 100 of each type and rating installed. Furnish at least one of each type.
 - 2. Diffusers and Lenses: One for every 100 of each type and rating installed. Furnish at least one of each type.
 - 3. Globes and Guards: One for every 20 of each type and rating installed. Furnish at least one of each type.

1.8 QUALITY ASSURANCE

- A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.
- B. Provide luminaires from a single manufacturer for each luminaire type.
- C. Each luminaire type shall be binned within a three-step MacAdam Ellipse to ensure color consistency among luminaires.

1.9 DELIVERY, STORAGE, AND HANDLING

- A. Protect finishes of exposed surfaces by applying a strippable, temporary protective covering before shipping.

1.10 WARRANTY

- A. Warranty: Manufacturer and Installer agree to repair or replace components of luminaires that fail in materials or workmanship within specified warranty period.
- B. Warranty Period:
 - 1. Material: Five years from date of Substantial Completion.
 - 2. Labor: One year from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Seismic Performance: Luminaires and lamps shall withstand the effects of earthquake motions and be labeled vibration and shock resistant.
 - 1. The term "withstand" means "the luminaire will remain in place without separation of any parts when subjected to the seismic forces specified and the luminaire will be fully operational during and after the seismic event."

2.2 LUMINAIRE REQUIREMENTS

- A. Standards:
 - 1. Design Lights Consortium (DLC) qualified products list or ENERGY STAR certified.
 - 2. UL 1598, Standard for Luminaires.
 - 3. Recessed luminaires shall comply with NEMA LE 4.
 - 4. UL Listing: Listed for damp or wet location as applicable.
- B. CRI minimum of 80 CCT at 4000 K.
- C. Rated lamp life of 50,000 hours minimum to L70.
- D. Lamps dimmable from 100 percent to 0 percent of maximum light output.
- E. Internal driver.

2.3 EMERGENCY LIGHTING UNITS

- A. General: Self-contained units complying with UL 924.
 - 1. LED lamp heads.
 - 2. Battery: Sealed, maintenance-free, nickel-cadmium or nickel metal hydride type with minimum 10-year nominal life and special warranty. Battery sized to provide emergency illumination for not less than 90 minutes.
 - 3. Charger: Fully automatic, solid-state type with sealed transfer relay.
 - 4. Operation: Relay automatically turns lamp on when power supply circuit voltage drops to 80 percent of nominal voltage or below. Lamp automatically disconnects from battery when voltage approaches deep-discharge level. When normal voltage is restored, relay disconnects lamps from battery, and battery is automatically recharged and floated on charger.
 - 5. Protective Guard: Where indicated, clear polycarbonate guard protects lamp heads or fixtures.
 - 6. Integral Time-Delay Relay: Holds unit on for fixed interval when power is restored after an outage; time delay permits high-intensity-discharge lamps to restrike and develop adequate output.

2.4 EXIT SIGNS

- A. General: Comply with UL 924; for sign colors and lettering size, comply with authorities having jurisdiction.
- B. Internally Lighted Signs:
 - 1. Lamps for AC Operation: Light-emitting diodes, 70,000 hours minimum of rated lamp life.
- C. Self-Powered Exit Signs (Battery Type): Integral automatic charger in a self-contained power pack.
 - 1. Battery: Sealed, maintenance-free, nickel-cadmium or nickel metal hydride type with special warranty. Battery sized to provide emergency illumination for not less than 90 minutes.
 - 2. Charger: Fully automatic, solid-state type with sealed transfer relay.
 - 3. Operation: Relay automatically energizes lamp from battery when circuit voltage drops to 80 percent of nominal voltage or below. When normal voltage is restored, relay disconnects lamps from battery, and battery is automatically recharged and floated on charger.

2.5 MATERIALS

- A. Metal Parts:
 - 1. Free of burrs and sharp corners and edges.
 - 2. Sheet metal components shall be steel unless otherwise indicated.
 - 3. Form and support to prevent warping and sagging.
- B. Doors, Frames, and Other Internal Access: Smooth operating, free of light leakage under operating conditions, and designed to permit relamping without use of tools. Designed to prevent doors, frames, lenses, diffusers, and other components from falling accidentally during relamping and when secured in operating position.
- C. Factory-Applied Labels: Comply with UL 1598. Include recommended lamps. Locate labels where they will be readily visible to service personnel, but not seen from normal viewing angles when lamps are in place. Label shall include the following lamp characteristics:
 - 1. "USE ONLY" and include specific lamp type.
 - 2. Lamp diameter, shape, size, wattage, and coating.
 - 3. CCT and CRI for all luminaires.

2.6 METAL FINISHES

- A. Variations in finishes are unacceptable in the same piece. Variations in finishes of adjoining components are acceptable if they are within the range of approved Samples and if they can be and are assembled or installed to minimize contrast.

2.7 LUMINAIRE SUPPORT

- A. Comply with requirements in Section "Basic Materials and Methods" for channel and angle iron supports.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates, areas, and conditions, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.
- B. Examine roughing-in for luminaire to verify actual locations of luminaire and electrical connections before luminaire installation. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

- A. Comply with NECA 1.
- B. Install luminaires level, plumb, and square with ceilings and walls unless otherwise indicated.
- C. Install lamps in each luminaire.
- D. Supports:
 - 1. Sized and rated for luminaire weight.
 - 2. Able to maintain luminaire position after cleaning and relamping.
 - 3. Provide support for luminaire without causing deflection of ceiling or wall.
 - 4. Luminaire mounting devices shall be capable of supporting a horizontal force of 100 percent of luminaire weight and vertical force of 400 percent of luminaire weight.
- E. Flush-Mounted Luminaire Support:
 - 1. Secured to outlet box.
 - 2. Attached to ceiling structural members at four points equally spaced around circumference of luminaire.
 - 3. Trim ring flush with finished surface.
- F. Wall-Mounted Luminaire Support:
 - 1. Attached to structural members in walls or a minimum 20 gauge backing plate attached to structure.
- G. Suspended Luminaire Support:
 - 1. Pendants and Rods: Where longer than 48 inches, brace to limit swinging.
 - 2. Stem-Mounted, Single-Unit Luminaires: Suspend with twin-stem hangers. Support with approved outlet box and accessories that hold stem and provide damping of luminaire oscillations. Support outlet box vertically to building structure using approved devices.

3. Continuous Rows of Luminaires: Use tubing or stem for wiring at one point and tubing for suspension for each unit length of luminaire chassis, including one at each end.
4. Do not use ceiling grid as support for pendant luminaires. Connect support wires or rods to building structure.

H. Ceiling-Grid-Mounted Luminaires:

1. Fixture is to be supported at two (2) opposite ends to the steel frame of the building using the same type of wire as used to support the lay-in ceiling track.
2. Support Clips:
 - a. Fasten fixtures to ceiling grid main runner members with manufacturer clips.
3. Fixtures of Sizes Less Than Ceiling Grid Pattern:
 - a. Install as indicated on reflected ceiling plans or center in acoustical panel.
 - b. Support fixtures independently with at least two 3/4-inch (metal channels spanning and secured to ceiling tees.
 - c. Fixture is to be supported at two (2) opposite ends to the steel frame of the building using the same type of wire as used to support the lay-in ceiling track

3.3 FIELD QUALITY CONTROL

- A. Perform the following tests and inspections:
 1. Operational Test: After installing luminaires, switches, and accessories; and after electrical circuitry has been energized, test units to confirm proper operation.
 2. Test for Emergency Lighting: Interrupt power supply to demonstrate proper operation. Verify normal transfer to battery power source and retransfer to normal. Perform a test on each unit after it is permanently installed and charged for a minimum of 24 hours. Battery shall be tested for 90 minutes. The battery test shall demonstrate compliance with the requirements of NEC 700.12(F). Repair and/or replace any units that fail the test, then retest.
- B. Luminaire will be considered defective if it does not pass operation tests and inspections.
- C. Corroded Fixtures: During warranty period, replace fixtures that show any signs of corrosion.

END OF SECTION 265119

SECTION 271100 - COMMUNICATIONS EQUIPMENT ROOM FITTINGS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section Includes:
 - 1. Telecommunications mounting elements.
 - 2. Backboards.
 - 3. Telecommunications equipment racks and cabinets.
 - 4. Telecommunications service entrance pathways.
 - 5. Grounding.
- B. Related Sections:
 - 1. Section "Communications Horizontal Cabling" for voice and data cabling associated with system panels and devices.
- C. BICSI: Building Industry Consulting Service International.
- D. RCDD: Registered Communications Distribution Designer.

1.3 PERFORMANCE REQUIREMENTS

- A. Seismic Performance: Floor-mounted cabinets and cable pathways shall withstand the effects of earthquake motions determined according to ASCE 7.
 - 1. The term "withstand" means "the unit will remain in place without separation of any parts from the device when subjected to the seismic forces specified."

1.4 SUBMITTALS

- A. Product Data: For each type of product indicated. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for equipment racks and cabinets. Include rated capacities, operating characteristics, electrical characteristics, and furnished specialties and accessories.
- B. Shop Drawings: For communications equipment room fittings. Include plans, elevations, sections, details, and attachments to other work.
 - 1. Detail equipment assemblies and indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.
 - 2. Equipment Racks and Cabinets: Include workspace requirements and access for cable connections.

3. Grounding: Indicate location of grounding bus bar and its mounting detail showing standoff insulators and wall mounting brackets.

- C. Qualification Data: For Installer, qualified layout technician, installation supervisor, and field inspector.

1.5 QUALITY ASSURANCE

- A. Installer Qualifications: Cabling Installer must have personnel certified by BICSI on staff.
 1. Layout Responsibility: Preparation of Shop Drawings shall be under the direct supervision of RCDD.
 2. Installation Supervision: Installation shall be under the direct supervision of Registered Technician, who shall be present at all times when Work of this Section is performed at Project site.
- B. 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.
- C. Telecommunications Pathways and Spaces: Comply with TIA/EIA-569-A.
- D. Grounding: Comply with ANSI-J-STD-607-A.

1.6 PROJECT CONDITIONS

- A. Environmental Limitations: Do not deliver or install equipment frames and cable trays until spaces are enclosed and weathertight, wet work in spaces is complete and dry, and work above ceilings is complete.

1.7 COORDINATION

- A. Coordinate layout and installation of communications equipment with Owner's telecommunications and LAN equipment and service suppliers. Coordinate service entrance arrangement with local exchange carrier.
 1. Meet jointly with telecommunications and LAN equipment suppliers, local exchange carrier representatives, and Owner to exchange information and agree on details of equipment arrangements and installation interfaces.
 2. Record agreements reached in meetings and distribute them to other participants.
 3. Adjust arrangements and locations of distribution frames, cross-connects, and patch panels in equipment rooms to accommodate and optimize arrangement and space requirements of telephone switch and LAN equipment.
 4. Adjust arrangements and locations of equipment with distribution frames, cross-connects, and patch panels of cabling systems of other communications, electronic safety and security, and related systems that share space in the equipment room.

- B. Coordinate location of power raceways and receptacles with locations of communications equipment requiring electrical power to operate.

PART 2 - PRODUCTS

2.1 PATHWAYS

- A. General Requirements: Comply with TIA/EIA-569-A.
- B. Cable Support: NRTL labeled. Cable support brackets shall be designed to prevent degradation of cable performance and pinch points that could damage cable. Cable tie slots fasten cable ties to brackets.
 - 1. Comply with NFPA 70 and UL 2043 for fire-resistant and low-smoke-producing characteristics.
 - 2. Support brackets with cable tie slots for fastening cable ties to brackets.
 - 3. Lacing bars, spools, J-hooks, and D-rings.
 - 4. Straps and other devices.
- C. Conduit and Boxes: Comply with requirements in Section "Raceway and Boxes".

2.2 BACKBOARDS

- A. Backboards: Plywood, fire-retardant treated, 3/4 by 48 by 96 inches (19 by 1220 by 2440 mm). Comply with requirements for plywood backing panels specified in Section "Rough Carpentry."

2.3 EQUIPMENT FRAMES

- 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. ADC.
 - 2. Aim Electronics; a brand of Emerson Electric Co.
 - 3. AMP; a Tyco International Ltd. company.
 - 4. Cooper B-Line, Inc.
 - 5. Hubbell Premise Wiring.
 - 6. KRONE Incorporated.
 - 7. Leviton Voice & Data Division.
 - 8. Middle Atlantic Products, Inc.
 - 9. Nordex/CDT; a subsidiary of Cable Design Technologies.
 - 10. Ortronics, Inc.
 - 11. Panduit Corp.
 - 12. Siemon Co. (The).
- B. General Frame Requirements:
 - 1. Distribution Frames: Wall-mounting, modular-steel units designed for telecommunications terminal support and coordinated with dimensions of units to be supported.

2. Module Dimension: Width compatible with EIA 310 standard, 19-inch (480-mm) panel mounting. Nominal dimensions are 20"W x 28"H x 30"D.
3. Finish: Manufacturer's standard, baked-polyester powder coat.

C. Modular Wall Cabinets:

1. Wall mounting.
2. Steel or aluminum construction.
3. Treated to resist corrosion.
4. Lockable front and rear doors.
5. Louvered side panels.
6. Cable access provisions top and bottom.
7. Grounding lug.
8. Power strip.
9. All cabinets keyed alike.

D. Cable Management for Equipment Frames:

1. Metal, with integral wire retaining fingers.
2. Baked-polyester powder coat finish.
3. Vertical cable management panels shall have front and rear channels, with covers.
4. Provide horizontal crossover cable manager at the top of each relay rack, with a minimum height of two rack units each.

2.4 GROUNDING

- A. Comply with requirements in Section "Grounding and Bonding." for grounding conductors and connectors.
- B. Telecommunications Main Bus Bar:
 1. Connectors: Mechanical type, cast silicon bronze, solderless compression-type wire terminals, and long-barrel, two-bolt connection to ground bus bar.
 2. Ground Bus Bar: Copper, minimum 1/4 inch thick by 2 inches wide with 9/32-inch holes spaced 1-1/8 inches apart.
 3. Stand-Off Insulators: Comply with UL 891 for use in switchboards, 600 V. Lexan or PVC, impulse tested at 5000 V.
- C. Comply with ANSI-J-STD-607-A.

2.5 LABELING

- A. Comply with TIA/EIA-606-A and UL 969 for a system of labeling materials, including label stocks, laminating adhesives, and inks used by label printers.

PART 3 - EXECUTION

3.1 ENTRANCE FACILITIES

- A. Contact telecommunications service provider and arrange for installation of demarcation point, protected entrance terminals, and a housing when so directed by service provider.
- B. Install underground pathways complying with recommendations in TIA/EIA-569-A, "Entrance Facilities" Article.

3.2 Install underground entrance pathway complying with Section "Raceway and Boxes for Electrical Systems."

3.3 INSTALLATION

- A. Comply with NECA 1.
- B. Comply with BICSI TDMM for layout and installation of communications equipment rooms.
- C. Bundle, lace, and train conductors and cables to terminal points without exceeding manufacturer's limitations on bending radii. Install lacing bars and distribution spools.

3.4 GROUNDING

- A. Install grounding according to BICSI TDMM, "Grounding, Bonding, and Electrical Protection" Chapter.
- B. Comply with ANSI-J-STD-607-A.
- C. Locate grounding bus bar to minimize the length of bonding conductors. Fasten to wall allowing at least 2-inch (50-mm) clearance behind the grounding bus bar. Connect grounding bus bar with a minimum No. 4 AWG grounding electrode conductor from grounding bus bar to suitable electrical building ground.
- D. Bond metallic equipment to the grounding bus bar, using not smaller than No. 6 AWG equipment grounding conductor.
 - 1. Bond the shield of shielded cable to the grounding bus bar in communications rooms and spaces.

3.5 IDENTIFICATION

- A. Identify system components, wiring, and cabling complying with TIA/EIA-606-A. Comply with requirements in Section "Identification for Electrical Systems." Comply with requirements in Section "Interior Painting" for painting backboards. For fire-resistant plywood, do not paint over manufacturer's label.

- B. See Section "Communications Horizontal Cabling" for additional identification requirements. See Evaluations for discussion of TIA/EIA standard as it applies to this Section.
- C. Labels shall be preprinted or computer-printed type.

END OF SECTION 271100

SECTION 271500 - COMMUNICATIONS HORIZONTAL CABLING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section Includes:
 - 1. Pathways.
 - 2. UTP cabling.
 - 3. Multiuser telecommunications outlet assemblies.
 - 4. Cable connecting hardware and patch panels.
 - 5. Telecommunications outlet/connectors.
 - 6. Cabling system identification products.

1.3 DEFINITIONS

- A. BICSI: Building Industry Consulting Service International.
- B. EMI: Electromagnetic interference.
- C. IDC: Insulation displacement connector.
- D. LAN: Local area network.
- E. Outlet/Connectors: A connecting device in the work area on which horizontal cable or outlet cable terminates.
- F. RCDD: Registered Communications Distribution Designer.
- G. UTP: Unshielded twisted pair.

1.4 HORIZONTAL CABLING DESCRIPTION

- A. Horizontal cable and its connecting hardware provide the means of transporting signals between the telecommunications outlet/connector and the horizontal cross-connect located in the communications equipment room. This cabling and its connecting hardware are called "permanent link," a term that is used in the testing protocols.
 - 1. TIA/EIA-568-B.1 requires that a minimum of two telecommunications outlet/connectors be installed for each work area.
 - 2. Bridged taps and splices shall not be installed in the horizontal cabling.
- B. The maximum allowable horizontal cable length is 295 feet (90 m). This maximum allowable length does not include an allowance for the length of 16 feet (4.9 m) to the

workstation equipment. The maximum allowable length does not include an allowance for the length of 16 feet (4.9 m) in the horizontal cross-connect.

1.5 PERFORMANCE REQUIREMENTS

- A. General Performance: Horizontal cabling system shall comply with transmission standards in TIA/EIA-568-B.1, when tested according to test procedures of this standard.

1.6 SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Qualification Data: For Installer, qualified layout technician, installation supervisor, and field inspector.
- C. Field quality-control reports.
- D. Maintenance Data: For splices and connectors to include in maintenance manuals.

1.7 QUALITY ASSURANCE

- A. Installer Qualifications: Cabling Installer must have personnel certified by BICSI on staff.
 - 1. Layout Responsibility: Preparation of Shop Drawings, Cabling Administration Drawings, and field testing program development by an RCDD.
 - 2. Installation Supervision: Installation shall be under the direct supervision of Registered Technician, who shall be present at all times when Work of this Section is performed at Project site.
- B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- C. Telecommunications Pathways and Spaces: Comply with TIA/EIA-569-A.
- D. Grounding: Comply with ANSI-J-STD-607-A.

1.8 DELIVERY, STORAGE, AND HANDLING

- A. Test cables upon receipt at Project site.
 - 1. Test each pair of UTP cable for open and short circuits.

1.9 PROJECT CONDITIONS

- A. Environmental Limitations: Do not deliver or install cables and connecting materials until wet work in spaces is complete and dry, and temporary HVAC system is operating and maintaining ambient temperature and humidity conditions at occupancy levels during the remainder of the construction period.

1.10 COORDINATION

- A. Coordinate layout and installation of telecommunications pathways and cabling with Owner's telecommunications and LAN equipment and service suppliers.
- B. Coordinate telecommunications outlet/connector locations with location of power receptacles at each work area.

PART 2 - PRODUCTS

2.1 PATHWAYS

- A. General Requirements: Comply with TIA/EIA-569-A.
- B. Cable Support: NRTL labeled for support of Category 6A cabling, designed to prevent degradation of cable performance and pinch points that could damage cable.
 - 1. Support brackets with cable tie slots for fastening cable ties to brackets.
 - 2. Lacing bars, spools, J-hooks, and D-rings.
 - 3. Straps and other devices.
- C. Conduit and Boxes: Comply with requirements in Section "Raceway and Boxes ."
 - 1. Outlet boxes shall be no smaller than 2 inches (50 mm) wide, 3 inches (75 mm) high, and 2-1/2 inches (64 mm) deep.

2.2 UTP CABLE

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. Belden CDT Inc.; Electronics Division.
 - 2. Berk-Tek; a Nexans company.
 - 3. CommScope, Inc.
 - 4. Draka USA.
 - 5. Genesis Cable Products; Honeywell International, Inc.
 - 6. KRONE Incorporated.
 - 7. Mohawk; a division of Belden CDT.
 - 8. Molex Premise Networks; a division of Molex, Inc.
 - 9. Nordex/CDT; a subsidiary of Cable Design Technologies.
 - 10. Superior Essex Inc.
 - 11. SYSTIMAX Solutions; a CommScope, Inc. brand.
 - 12. 3M.
 - 13. Tyco Electronics/AMP Netconnect; Tyco International Ltd.
- B. Description: 100-ohm, 4-pair UTP, covered with a blue thermoplastic jacket.
 - 1. Comply with ICEA S-90-661 for mechanical properties.
 - 2. Comply with TIA/EIA-568-B.1 for performance specifications.
 - 3. Comply with TIA/EIA-568-B.2, Category 6A.
 - 4. Listed and labeled by an NRTL acceptable to authorities having jurisdiction as complying with UL 444 and NFPA 70 for the following types:

- a. Communications, General Purpose: Type CM or CMG.
- b. Communications, Plenum Rated: Type CMP, complying with NFPA 262.
- c. Communications, Riser Rated: Type CMR, complying with UL 1666.
- d. Communications, Limited Purpose: Type CMX.
- e. Multipurpose: Type MP or MPG.
- f. Multipurpose, Plenum Rated: Type MPP, complying with NFPA 262.
- g. Multipurpose, Riser Rated: Type MPR, complying with UL 1666.

2.3 UTP CABLE HARDWARE

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. American Technology Systems Industries, Inc.
 - 2. Dynacom Corporation.
 - 3. Hubbell Premise Wiring.
 - 4. KRONE Incorporated.
 - 5. Leviton Voice & Data Division.
 - 6. Molex Premise Networks; a division of Molex, Inc.
 - 7. Nordex/CDT; a subsidiary of Cable Design Technologies.
 - 8. Panduit Corp.
 - 9. Siemon Co. (The).
 - 10. Tyco Electronics/AMP Netconnect; Tyco International Ltd.
- B. General Requirements for Cable Connecting Hardware: Comply with TIA/EIA-568-B.2, IDC type, with modules designed for punch-down caps or tools. Cables shall be terminated with connecting hardware of same category or higher.
- C. Connecting Blocks: 110-style IDC for Category 6A. Provide blocks for the number of cables terminated on the block, plus 25 percent spare. Integral with connector bodies, including plugs and jacks where indicated.
- D. Patch Panel: Modular panels housing multiple-numbered jack units with IDC-type connectors at each jack for permanent termination of pair groups of installed cables.
 - 1. Number of Jacks per Field: One for each four-pair conductor group of cables, plus spares and blank positions adequate to suit specified expansion criteria.
- E. Jacks and Jack Assemblies: Modular, color-coded, eight-position modular receptacle units with integral IDC-type terminals.
- F. Patch Cords: Factory-made, four-pair cables in 48-inch (1200-mm) lengths; terminated with eight-position modular plug at each end.
 - 1. Patch cords shall have bend-relief-compliant boots and color-coded icons to ensure Category 6A performance. Patch cords shall have latch guards to protect against snagging.

2.4 TELECOMMUNICATIONS OUTLET/CONNECTORS

- A. Jacks: 100-ohm, balanced, twisted-pair connector; four-pair, eight-position modular. Comply with TIA/EIA-568-B.1.
- B. Workstation Outlets:
 - 1. Two-port-connector assemblies mounted in single faceplate.
 - 2. Four-port-connector assemblies mounted in multigang faceplate.
 - 3. See drawings for other outlet quantities for number of ports. Mount assemblies in multigang faceplate.
 - 4. Metal Faceplate: Stainless steel, complying with requirements in Section "Wiring Devices."
 - 5. For use with snap-in jacks accommodating any combination of UTP, optical fiber, and coaxial work area cords.
 - a. Flush mounting jacks.
 - 6. Legend: Machine printed, in the field, using adhesive-tape label.
 - 7. Legend: Snap-in, clear-label covers and machine-printed paper inserts.

2.5 GROUNDING

- A. Comply with requirements in Section "Grounding and Bonding for Electrical Systems" for grounding conductors and connectors.
- B. Comply with ANSI-J-STD-607-A.

2.6 IDENTIFICATION PRODUCTS

- A. Comply with TIA/EIA-606-A and UL 969 for labeling materials, including label stocks, laminating adhesives, and inks used by label printers.
- B. Comply with requirements in Section "Identification for Electrical Systems."

2.7 SOURCE QUALITY CONTROL

- A. Factory test UTP cables on reels according to TIA/EIA-568-B.1.
- B. Factory test UTP cables according to TIA/EIA-568-B.2.
- C. Cable will be considered defective if it does not pass tests and inspections.
- D. Prepare test and inspection reports.

PART 3 - EXECUTION

3.1 WIRING METHODS

- A. Wiring Method: Install cables in raceways and cable trays except within consoles, cabinets, desks, and counters and except in accessible ceiling spaces and attics,

where unenclosed wiring method may be used. Conceal raceway except in unfinished spaces.

1. Install plenum cable in environmental air spaces, including plenum ceilings.
2. Comply with requirements for raceways and boxes specified in Section "Raceway and Boxes."

- B. Wiring within Enclosures: Bundle, lace, and train cables to terminal points with no excess and without exceeding manufacturer's limitations on bending radii. Provide and use lacing bars and distribution spools.

3.2 INSTALLATION OF PATHWAYS

- A. Comply with TIA/EIA-569-A for pull-box sizing and length of conduit and number of bends between pull points.
- B. Comply with requirements in Section "Raceway and Boxes" for installation of conduits and wireways.
- C. Install manufactured conduit sweeps and long-radius elbows whenever possible.

3.3 INSTALLATION OF CABLES

- A. Comply with NECA 1.
- B. General Requirements for Cabling:
1. Comply with TIA/EIA-568-B.1.
 2. Comply with BICSI ITSIM, Ch. 6, "Cable Termination Practices."
 3. Install 110-style IDC termination hardware unless otherwise indicated.
 4. Terminate conductors; no cable shall contain unterminated elements. Make terminations only at indicated outlets, terminals, cross-connects, and patch panels.
 5. Cables may not be spliced. Secure and support cables at intervals not exceeding 30 inches (760 mm) and not more than 6 inches (150 mm) from cabinets, boxes, fittings, outlets, racks, frames, and terminals.
 6. Install lacing bars to restrain cables, to prevent straining connections, and to prevent bending cables to smaller radii than minimums recommended by manufacturer.
 7. Bundle, lace, and train conductors to terminal points without exceeding manufacturer's limitations on bending radii, but not less than radii specified in BICSI ITSIM, "Cabling Termination Practices" Chapter. Install lacing bars and distribution spools.
 8. Do not install bruised, kinked, scored, deformed, or abraded cable. Do not splice cable between termination, tap, or junction points. Remove and discard cable if damaged during installation and replace it with new cable.
 9. Cold-Weather Installation: Bring cable to room temperature before dereeling. Heat lamps shall not be used for heating.
 10. In the communications equipment room, install a 10-foot- (3-m-) long service loop on each end of cable.

11. Pulling Cable: Comply with BICSI ITSIM, Ch. 4, "Pulling Cable." Monitor cable pull tensions.
- C. UTP Cable Installation:
1. Comply with TIA/EIA-568-B.2.
 2. Do not untwist UTP cables more than 1/2 inch (12 mm) from the point of termination to maintain cable geometry.
- D. Open-Cable Installation:
1. Install cabling with horizontal and vertical cable guides in telecommunications spaces with terminating hardware and interconnection equipment.
 2. Suspend UTP cable not in a wireway or pathway a minimum of 8 inches (200 mm) above ceilings by cable supports not more than 60 inches (1524 mm) apart.
 3. Cable shall not be run through structural members or in contact with pipes, ducts, or other potentially damaging items.
- E. Group connecting hardware for cables into separate logical fields.
- F. Separation from EMI Sources:
1. Comply with BICSI TDMM and TIA/EIA-569-A for separating unshielded copper voice and data communication cable from potential EMI sources, including electrical power lines and equipment.
 2. Separation between communications cables in grounded metallic raceways and power lines and electrical equipment located in grounded metallic conduits or enclosures shall be as follows:
 - a. Electrical Equipment Rating Less Than 2 kVA: No requirement.
 - b. Electrical Equipment Rating between 2 and 5 kVA: A minimum of 3 inches (76 mm).
 - c. Electrical Equipment Rating More Than 5 kVA: A minimum of 6 inches (150 mm).
 3. Separation between Communications Cables and Electrical Motors and Transformers, 5 kVA or HP and Larger: A minimum of 48 inches (1200 mm).
 4. Separation between Communications Cables and Fluorescent Fixtures: A minimum of 5 inches (127 mm).
- 3.4 GROUNDING
- A. Install grounding according to BICSI TDMM, "Grounding, Bonding, and Electrical Protection" Chapter.
- B. Comply with ANSI-J-STD-607-A.
- C. Locate grounding bus bar to minimize the length of bonding conductors. Fasten to wall allowing at least 2-inch (50-mm) clearance behind the grounding bus bar. Connect grounding bus bar with a minimum No. 4 AWG grounding electrode conductor from grounding bus bar to suitable electrical building ground.

- D. Bond metallic equipment to the grounding bus bar, using not smaller than No. 6 AWG equipment grounding conductor.

3.5 IDENTIFICATION

- A. Identify system components, wiring, and cabling complying with TIA/EIA-606-A. Comply with requirements for identification specified in Section "Identification for Electrical Systems."
- B. Cable Schedule: Post in prominent location in each equipment room and wiring closet. List incoming and outgoing cables and their designations, origins, and destinations. Protect with rigid frame and clear plastic cover. Furnish an electronic copy of final comprehensive schedules for Project.
- C. Cabling Administration Drawings: Show building floor plans with cabling administration-point labeling. Identify labeling convention and show labels for telecommunications closets, backbone pathways and cables, entrance pathways and cables, terminal hardware and positions, horizontal cables, work areas and workstation terminal positions, grounding buses and pathways, and equipment grounding conductors. Follow convention of TIA/EIA-606-A. Furnish electronic record of all drawings, in software and format selected by Owner.
- D. Cable and Wire Identification:
 - 1. Label each cable within 4 inches (100 mm) of each termination, where it is accessible in a cabinet or junction or outlet box, and elsewhere as indicated.
 - 2. Each wire connected to building-mounted devices is not required to be numbered at device if color of wire is consistent with associated wire connected and numbered within panel or cabinet.
 - 3. Exposed Cables and Cables in Cable Trays and Wire Troughs: Label each cable at intervals not exceeding 30 feet (9 m).
 - 4. Label each terminal strip and screw terminal in each cabinet, rack, or panel.
 - a. Individually number wiring conductors connected to terminal strips, and identify each cable or wiring group being extended from a panel or cabinet to a building-mounted device shall be identified with name and number of particular device as shown.
 - b. Label each unit and field within distribution racks and frames.
 - 5. Identification within Connector Fields in Equipment Rooms and Wiring Closets: Label each connector and each discrete unit of cable-terminating and connecting hardware. Where similar jacks and plugs are used for both voice and data communication cabling, use a different color for jacks and plugs of each service.
- E. Labels shall be preprinted or computer-printed type with printing area and font color that contrasts with cable jacket color but still complies with requirements in TIA/EIA-606-A.
 - 1. Cables use flexible vinyl or polyester that flex as cables are bent.

3.6 FIELD QUALITY CONTROL

- A. Perform tests and inspections.
- B. Tests and Inspections:
 - 1. Visually inspect UTP cable jacket materials for NRTL certification markings. Inspect cabling terminations in communications equipment rooms for compliance with color-coding for pin assignments, and inspect cabling connections for compliance with TIA/EIA-568-B.1.
 - 2. Visually confirm Category 6A, marking of outlets, cover plates, outlet/connectors, and patch panels.
 - 3. Visually inspect cable placement, cable termination, grounding and bonding, equipment and patch cords, and labeling of all components.
 - 4. UTP Performance Tests:
 - a. Test for each outlet and MUTOA. Perform the following tests according to TIA/EIA-568-B.1 and TIA/EIA-568-B.2:
 - 1) Wire map.
 - 2) Length (physical vs. electrical, and length requirements).
 - 3) Insertion loss.
 - 4) Near-end crosstalk (NEXT) loss.
 - 5) Power sum near-end crosstalk (PSNEXT) loss.
 - 6) Equal-level far-end crosstalk (ELFEXT).
 - 7) Power sum equal-level far-end crosstalk (PSELFEXT).
 - 8) Return loss.
 - 9) Propagation delay.
 - 10) Delay skew.
- C. Document data for each measurement. Data for submittals shall be printed in a summary report that is formatted similar to Table 10.1 in BICSI TDMM, or transferred from the instrument to the computer, saved as text files, and printed and submitted.
- D. End-to-end cabling will be considered defective if it does not pass tests and inspections.
- E. Prepare test and inspection reports.

3.7 DEMONSTRATION

- A. Train Owner's maintenance personnel in cable-plant management operations, including changing signal pathways for different workstations, rerouting signals in failed cables, and keeping records of cabling assignments and revisions when extending wiring to establish new workstation outlets.

END OF SECTION 271500

SECTION 283111 - DIGITAL, ADDRESSABLE FIRE-ALARM SYSTEM

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SYSTEM DESCRIPTION

- A. Microprocessor controlled, intelligent reporting fire detection and alarm system.

1.3 SUMMARY

- A. Section Includes:
 - 1. Fire-alarm control unit.
 - 2. Manual fire-alarm boxes.
 - 3. System smoke detectors.
 - 4. Heat detectors.
 - 5. Notification appliances.
 - 6. Addressable interface device.
 - 7. Digital alarm communicator transmitter.

1.4 DEFINITIONS

- A. AHJ: Authority Having Jurisdiction.
- B. AHU: Air Handler Unit.
- C. IR: Infrared.
- D. LED: Light-emitting diode.
- E. NICET: National Institute for Certification in Engineering Technologies.
- F. NRTL: Nationally Recognized Testing Laboratory.
- G. UV: Ultraviolet.

1.5 PERFORMANCE REQUIREMENTS

- A. Comply with applicable provisions of the North Carolina State Building Code.
- B. Comply with applicable provisions of NFPA 70, National Electrical Code.
- C. Comply with applicable provisions of NFPA 72, National Fire Alarm Code.

- D. Equipment supplied shall be specifically listed for its intended use and shall be installed in accordance with the manufacturer's instructions.
- E. Seismic Performance: Fire-alarm control unit and raceways shall withstand the effects of earthquake motions determined according to SEI/ASCE 7.
 - 1. The term "withstand" means "the unit will remain in place without separation of any parts from the device when subjected to the seismic forces specified and the unit will be fully operational after the seismic event."

1.6 QUALITY ASSURANCE

- A. Manufacturer's Qualifications:
 - 1. Firms shall be regularly engaged in the manufacture of fire alarm systems of the types, sizes, and electrical characteristics required for this project.
 - 2. The system shall comply with provisions of UL safety standards pertaining to fire detection and alarm systems. Products and components shall be Listed and Labeled.
 - 3. Fire detection and alarm systems and accessories shall be FM approved.
 - 4. Firms shall maintain factory authorized service organization. Firms shall maintain spare parts stock.
- B. Designer for Preparation of Shop Drawings and Calculations Qualifications:
 - 1. Personnel shall be trained and certified by manufacturer for system design required for this Project.
 - 2. Personnel shall be certified by NICET as fire-alarm Level III (minimum) technician.
- C. Installer Qualifications:
 - 1. Personnel shall be trained and certified by manufacturer for installation of units required for this Project.
 - 2. Supervisor of installation shall be certified by NICET as fire-alarm Level II (minimum) technician.
 - 3. Supervisor of installation shall be certified as an authorized representative of the equipment manufacturer.
 - 4. Minimum of 5 years of experience installing fire detection and alarm systems similar in size and scope to this project.
- D. Manufacturer's Field Service Technician Qualifications:
 - 1. Personnel shall be trained and certified by manufacturer for installation of units specifically required for this Project within the most recent 36 months.
 - 2. Personnel shall be certified by NICET as fire-alarm Level II (minimum) technician.
 - 3. If not trained by the manufacturer within 36 months (as noted in 1 above), but within 48 months, NICET fire alarm Level III (minimum) technician certification is required.
- E. Source Limitations for Fire-Alarm System and Components:

1. Obtain fire-alarm system equipment and components from a single source.
2. For facilities with existing functional systems in place, new components shall be compatible and listed for use with, and operate as, an extension of existing system.

- F. Electrical Components, Devices, and Accessories: Listed and labeled by a third party agency that is accredited by the NCBCC (North Carolina Building Code Council) to label electrical & mechanical equipment.
- G. NFPA Certification: Obtain certification according to NFPA 72 by a UL-listed alarm company.

1.7 SUBMITTALS

A. Qualification Data:

1. Designer:
 - a. Manufacturer training certification.
 - b. NICET certification
2. Installer:
 - a. Manufacturer training certification.
 - b. NICET certification.
 - c. Authorized representative of equipment manufacturer certification.
 - d. Experience documentation; 5 years of similar size & scope projects.
3. Manufacturer Field Service Technician:
 - a. Manufacturer training certification.
 - b. NICET certification.

B. Product Data:

1. Manufacturer data for each type of product, equipment, device, etc. proposed.
2. For devices, include milliamp (mA) draw and listed minimum voltage required to operate for each type of device.
3. For panels and power supplies, include voltage drop allowed for the panel and power supplies.
4. For panels and power supplies, include voltage drop for individual Notification Appliance Circuits (NAC).

C. Shop Drawings: For fire-alarm system to demonstrate compliance with project drawings and specifications. Include plans, elevations, sections, details, and attachments to other work.

1. Comply with recommendations in the "Documentation" Section of the "Fundamentals of Fire Alarm Systems" Chapter in NFPA 72.
2. Provide floor plans with:
 - a. Final equipment and device locations, including address of each addressable device and notification appliance.
 - b. Wiring diagrams with proposed conduit routing and conductors/cables in each conduit section.

- c. Distances for NAC circuitry sections.
- 3. Provide voltage drop calculations for notification appliance circuits. Voltage drop at EOL device shall not exceed 14% of the battery voltage. Worst case voltage at each notification appliance shall be no less than the minimum listed operating voltage.
- 4. Provide battery calculations.
- 5. System Response Matrix: Indicate fire alarm system's actions (outputs) required for each type of alarm, supervisory, and trouble signal.
- 6. Duct detectors: Provide performance parameters and installation details for detectors, verifying that each detector is listed for complete range of air velocity, temperature, and humidity possible when air-handling system is operating.
- D. Installation Instructions: Manufacturer's detailed installation instructions for Fire Alarm Control Unit, duct mounted smoke detectors, flow switches, tamper switches, supervisory switches, and similar items which require mechanical installation.
- E. Seismic Qualification Certificates: For fire-alarm control unit, accessories, and components, from manufacturer.
 - 1. Basis for Certification: Indicate whether withstand certification is based on actual test of assembled components or on calculation.
 - 2. Dimensioned Outline Drawings of Equipment Unit: Identify center of gravity and locate and describe mounting and anchorage provisions.
 - 3. Detailed description of equipment anchorage devices on which the certification is based and their installation requirements.
- F. Field quality-control reports.
- G. Operation and Maintenance Data: For fire-alarm systems and components to include in emergency, operation, and maintenance manuals. In addition to items specified in Section "Operation and Maintenance Data," include the following:
 - 1. Comply with the "Records" Section of the "Inspection, Testing and Maintenance" Chapter in NFPA 72.
 - 2. Provide "Record of Completion Documents" according to NFPA 72 article "Permanent Records" in the "Records" Section of the "Inspection, Testing and Maintenance" Chapter.
 - 3. System Status and Programming Report.
 - 4. Record copy of site-specific software on CD and USB flash drive (thumb drive).
 - 5. As-built documents.
 - a. Provide duplicates of the shop drawing plans, wiring diagrams, and riser diagrams showing comprehensive and clear field revisions. Include loop numbers, device addresses, terminal numbers where connected to equipment, and wire color codes.
 - b. Provide a drawing with submitted battery and voltage drop calculations. Include a field for entering actual metered values during system testing.
 - 6. Technical literature for all control equipment, devices, isolation modules, relays, power supplies, alarm/supervisory signal initiating devices, etc. Include maintenance data and parts lists. Include circuit diagrams of all control panels, modules, annunciators, communications panels, etc.

7. Provide "Maintenance, Inspection and Testing Records" according to NFPA 72 article of the same name and include the following:
 - a. Frequency of testing of installed components.
 - b. Frequency of inspection of installed components.
 - c. Requirements and recommendations related to results of maintenance.
 - d. Manufacturer's user training manuals.
8. Manufacturer's required maintenance related to system warranty requirements.
9. Abbreviated operating instructions, framed and mounted at fire-alarm control unit.

1.8 SOFTWARE SERVICE AGREEMENT

- A. Comply with UL 864.
- B. Technical Support: Beginning with Final Acceptance, provide software support for one year.
- C. Upgrade Service:
 1. Update software to latest version at Project completion.
 2. The manufacturer and authorized distributor of the system installed shall maintain software records on the system installed.
 3. At no charge, install and program software upgrades that become available within one year from date of Final Acceptance and for the life of the warranty period. Upgrading software shall include operating system. Upgrade shall include new or revised licenses for use of software.
 4. For new software versions that correct operating problems or bugs, free upgrades shall be provided during the life of the system.
 5. Provide 30 days notice to Owner to allow scheduling and access to system and to allow Owner to upgrade computer equipment if necessary.

1.9 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. Manual Fire Alarm Boxes: 2% of installed quantity, but no fewer than 1 unit of each type.
 2. Addressable Control Relays: 4% of installed quantity, but no fewer than 1 unit of each type.
 3. Indoors Horn/Strobes: 4% of installed quantity, but no fewer than 1 unit of each type.
 4. Indoor Strobes: 4% of installed quantity, but no fewer than 1 unit of each type.
 5. Monitor Modules (Addressable Interface): 4% of installed quantity, but no fewer than 1 unit of each type.
 6. Isolation Modules: 4% of installed quantity, but no fewer than 1 unit of each type.
 7. Addressable Heat Detectors: 4% of installed quantity, but no fewer than 1 unit of each type.
 8. Smoke Detectors, Fire Detectors: 6% of installed quantity, but no fewer than 1 unit of each type.

9. Detector Bases: Quantity equal to 2 percent of amount of each type installed, but no fewer than 1 unit of each type.
10. Lamps for Remote Indicating Lamp Units: Quantity equal to 10 percent of amount installed, but no fewer than 1 unit.
11. Keys and Tools: One extra set for access to locked and tamper-proofed components.
12. Fuses: Two of each type and rating installed in the system.
13. Interconnection cable, where required, for connecting the FACU to a personal computer.

1.10 WARRANTY

- A. Provide parts and labor warranty of one year from the date of final inspection and/or acceptance by the Owner.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 1. Fire Lite Alarms.
 2. Edwards.
 3. Notifier.
 4. Siemens Building Technologies, Inc.; Fire Safety Division.
 5. Silent Knight.

2.2 SYSTEMS OPERATIONAL DESCRIPTION

- A. Fire-alarm signal initiation shall be by one or more of the following devices and systems:
 1. Manual stations.
 2. Heat detectors.
 3. Smoke detectors.
 4. Automatic sprinkler system water flow.
- B. Fire-alarm signal shall initiate the following actions:
 1. Record events in the system memory.
 2. Continuously operate alarm notification appliances until initiating device and control unit have been reset.
 3. Identify alarm at fire-alarm control unit with flashing LED, audible piezo-electric signal, and LCD display of alarm point and location.
 4. Identify alarm at fire-alarm remote annunciator with flashing LED, audible piezo-electric signal, and LCD display of alarm point and location.
 5. Transmit an alarm signal to the remote alarm receiving station.
- C. Supervisory signal initiation shall be by one or more of the following devices and actions:
 1. Valve supervisory switch.

2. Low-air-pressure switch of a dry-pipe sprinkler system.

D. System trouble signal initiation shall be by one or more of the following devices and actions:

1. Open circuits, shorts, and grounds in designated circuits.
2. Opening, tampering with, or removing alarm-initiating and supervisory signal-initiating devices.
3. Ground or a single break in fire-alarm control unit internal circuits.
4. Break in standby battery circuitry.
5. Failure of battery charging.
6. Abnormal position of any switch at fire-alarm control unit or annunciator.
7. Loss of primary power or abnormal ac voltage at fire-alarm control unit.
8. HVAC bypass defeat switch in bypass position.
9. Fire-pump power failure, including a dead-phase or phase-reversal condition.
10. Low-air-pressure switch operation on a dry-pipe or preaction sprinkler system.

E. System Trouble and Supervisory Signal Actions:

1. Initiate annunciation at fire-alarm control unit and remote annunciators.
2. Provide adjustable time delay capability of 0 to 60 minutes to delay transmission of the trouble signals. The delay for loss of primary power or abnormal ac voltage shall be 1 to 3 hours.

2.3 FIRE-ALARM CONTROL UNIT

A. General Requirements for Fire-Alarm Control Unit (FACU):

1. Field-programmable, microprocessor-based, modular, power-limited design with electronic modules, complying with UL 864 and listed and labeled by an NRTL.
 - a. System software and programs shall be held in flash electrically erasable programmable read-only memory (EEPROM), retaining the information through failure of primary and secondary power supplies.
 - b. Include a real-time clock for time annotation of events on the event recorder. Time of day and date shall be retained upon loss of system primary and secondary power.
 - c. The system shall have multiple access levels for Owner authorized personnel to disable individual alarm inputs or normal system responses for alarms, without changing the system's programming.
 - d. Programming and editing of the existing program shall be possible without special equipment and without interrupting alarm monitoring functions.
2. Enclosure:
 - a. 3rd party listed cabinet suitable for surface, flush, or semi-flush mounting.
 - b. Finish: Rust resistant primer and manufacturer standard finish.
 - c. Door hinged on either right or left side (field selectable).
 - d. Door with key lock and glass opening for viewing all indicators.
 - e. Manufacturer's trim kit for flush or semi-flush mounting.
3. Addressable initiation devices that communicate device identity and status (normal, trouble, and alarm conditions).

- a. Smoke sensors shall additionally communicate sensitivity setting and allow for adjustment of sensitivity at fire-alarm control unit.
 - b. Temperature sensors shall additionally test for and communicate the sensitivity range of the device.
 - c. Alarm Verification: The system shall provide, as a feature, an alternate signal processing algorithm to verify the presence of smoke. The algorithm shall be selectable when programming. The total effective delay created by the algorithm shall not exceed 60 seconds.
 4. Addressable control circuits for shutdown of mechanical equipment.
 5. Signaling Line Circuits (SLC) Interface Boards:
 - a. Integral microprocessor with capability of operating locally in the event of FACU main microprocessor.
 - b. Provides power and communication with devices on SLC circuit loop.
 - c. 198 intelligent/addressable devices minimum per circuit; 99 analog detectors and 99 monitor or control modules.
 - d. Receives and processes analog information from all detectors with software to automatically maintain detectors' desired sensitivity levels
 - e. Automatic detector testing and determination of detector maintenance requirements.
 6. The system shall retain historical data and device parameters including device sensitivity measurement testing results. The system shall have the capability to display and print device data, parameters, and sensitivity test results. Trouble indication shall be initiated when any smoke detector approaches 80% of its alarm threshold due to gradual contamination.
- B. Alphanumeric Display and System Controls: Arranged for interface between human operator at fire-alarm control unit and addressable system components including annunciation and supervision. Display alarm, supervisory, and component status messages and the programming and control menu.
1. Annunciator and Display: Liquid-crystal type, backlit, 3 lines (minimum) of 80 characters, minimum.
 2. Individual, color-coded system status LEDs for AC POWER, SYSTEM ALARM, SYSTEM TROUBLE, and SIGNAL SILENCE.
 3. Keypad: Alphanumeric; arranged to permit entry and execution of field programming, display, and control commands.
 4. Operator interface functions:
 - a. Acknowledge Switch.
 - b. Alarm Silence Switch with a Subsequent Alarm resound feature.
 - c. System Reset Switch.
 - d. System Test Switch.
 - e. Lamp Test Switch.
- C. Circuits:
1. Notification Appliance Circuits (NAC):
 - a. NFPA 72 Class B.
 - b. End of line (EOL) resistors shall be installed for FACU supervision of circuit integrity. Locate EOL resistors as follows:

- 1) Where accessible to fire alarm system maintenance personnel.
 - 2) Where maintenance or testing at the EOL resistor location will not be disruptive to the normal use of the facility.
 - 3) Where not easily accessible to the normal building occupants.
 - 4) Where no higher than 9' AFF or lower than 7' AFF.
 - 5) Not in stairwells or restrooms.
- c. NAC circuits shall not exceed 75% of maximum load current allowed.
2. Signaling Line Circuits (SLC): NFPA 72 Class A, no "T" taps, and a minimum of 20% spare addresses.
3. Initiating Device Circuits (IDC): NFPA 72 Class A.
4. Digital electronic signals shall utilize check digits or multiple polling to prevent a single ground or open on any NAC, SLC, or IDC from causing system malfunction, loss of operating power, or the ability to report an alarm.
5. Serial Interfaces: One RS-232 ports for printers.
6. Wiring Methods:
 - a. All fire alarm circuitry shall be in $\frac{3}{4}$ " minimum metal conduit or metal clad fire alarm Type MC cable where concealed. Use surface metal raceway where exposed. Junction boxes and covers not in finished areas shall be painted red. PVC conduit may be used underground, in concrete, or in locations subject to severe corrosion.
 - b. SLC addressable loop circuits shall be wired with type FPL/FLLR/FPLP fire alarm cable, 18 AWG minimum, low capacitance, copper, twisted pair. Cable jacket shall have a red jacket with red and black conductor insulation. For underground circuits, use type TC or PLTC cable (PE insulated).
 - c. All other circuits shall be wired with 14 AWG minimum, stranded copper, type THHN/THWN conductors. Color codes follow:
 - 1) Initiating Circuits, General: Red(+) / White(-).
 - 2) Initiating Circuits, Smoke Only: Violet(+) / Gray(-).
 - 3) Notification Appliance / alarm initiating circuits: Blue(+) / Black(-).
 - 4) AHU Shutdown Circuits: Yellow(+) / Brown(-).
 - 5) Door Control Circuits (magnet power): Orange(+) / Orange(-).
 - 6) Elevator Capture Circuits: Brown.
 - 7) Separate 24 VDC operating power (for equipment): Yellow(+) / Brown(-).
 - 8) Circuits from zone adapter modules (ZAMs) to monitored devices: Violet(+) / Gray(-).
 - d. Conduits that penetrate exterior walls shall be sealed with non-hardening electrical putty to prevent condensation infiltration.
 - e. Splices are allowed only at device terminals or on terminal blocks in cabinets.
 - f. Terminal block screws shall have pressure wire connectors of the self-lifting or box lug type.
 - g. Permanent wire markers shall be used to label connections at the FACU, other control equipment, power supplies, and in terminal cabinets.
 - h. Branch circuit breakers supplying 120 VAC to system equipment shall be physically protected with a breaker handle lock and identified with a $\frac{1}{4}$ "

permanent red dot applied to the breaker handle or exposed body area. The red identification shall not damage the overcurrent protective devices or obscure the manufacturer's markings.

- D. Remote Smoke-Detector Sensitivity Adjustment: Controls shall select specific addressable smoke detectors for adjustment, display their current status and sensitivity settings, and change those settings. Allow controls to be used to program repetitive, time-scheduled, and automated changes in sensitivity of specific detector groups. Record sensitivity adjustments and sensitivity-adjustment schedule changes in system memory
- E. AHU Shutdown Defeat Toggle Switch: A supervised toggle switch shall be provided in/adjacent to the Fire Alarm Control Unit, or as a key operated function in a Remote Annunciator. If installed at the Remote Annunciator, provide an engraved label at the FACU with AHU Shutdown Defeat Switch location. When placed in the Shutdown Defeat position, a system "trouble" signal shall be initiated.
- F. Transmission to Remote Alarm Receiving Station: Automatically transmit alarm, supervisory, and trouble signals to a remote alarm station.
- G. Primary Power: 24-V dc obtained from 120-V ac service and a power-supply module. Initiating devices, notification appliances, signaling lines, trouble signals, supervisory signals supervisory and digital alarm communicator transmitters shall be powered by 24-V dc source.
 - 1. Alarm current draw of entire fire-alarm system shall not exceed 80 percent of the power-supply module rating.
 - 2. 120V power supply entry point to the FACU enclosure shall be where designated by the manufacturer.
 - 3. 120V branch breaker shall be physically protected with a handle lock and identified with a 1/4" diameter permanent red dot applied to the breaker handle or exposed body area.
- H. Secondary Power: 24-V dc supply system with batteries, automatic battery charger, and automatic transfer switch.
 - 1. Batteries:
 - a. Gel-cell, sealed, plate nickel cadmium, maintenance free.
 - b. Minimum of 60 hours standby capacity plus:
 - 1) 5 minutes of horn/strobe full alarm load.
 - 2. Charger: Dual-rate charging techniques for fast battery recharge.
- I. Instructions: Computer printout or typewritten instruction card mounted behind a plastic or glass cover in a stainless-steel or aluminum frame. Include interpretation and describe appropriate response for displays and signals. Briefly describe the functional operation of the system under normal, alarm, and trouble conditions.

2.4 MANUAL FIRE-ALARM BOXES

- A. General Requirements for Manual Fire-Alarm Boxes:

1. Comply with UL 38.
2. Single-action mechanism, pull-lever type; with integral addressable module arranged to communicate manual-station status (normal, alarm, or trouble) to fire-alarm control unit.
3. Positive, visual indication of operation.
4. Station Test and Reset: Key-operated switch.
5. Boxes shall be finished in red with molded, raised-letter operating instructions in contrasting color; shall show visible indication of operation; and shall be mounted on recessed outlet box. If indicated as surface mounted, provide manufacturer's surface back box.
6. Where new devices are shown utilizing existing device conduit and/or back box locations, temporarily hang or support existing devices in a manner that allows full functionality of the existing device while the new device is installed and brought online.
7. Pull Station Cover with Horn: Provide cover for all manual pull stations.
 - a. Clear, tamperproof, polycarbonate cover hinged at the top to permit lifting for access to initiate an alarm. Lifting the cover actuates an integral battery-powered audible horn intended to discourage false-alarm operation.
 - b. Listed for outdoor use for outdoor pull stations.
 - c. Flush mount cover for recessed boxes. Surface mount cover with conduit spacer for applications requiring surface mounted conduit.

2.5 SMOKE DETECTORS

A. General Requirements for System Smoke Detectors:

1. Comply with UL 268; operating at 24-V dc, nominal.
2. Detectors shall typically be two-wire type for connection to an SLC. Four-wire type detectors may be required if connecting to an existing four-wire system.
3. Integral Addressable Module: Arranged to communicate detector status (normal, alarm, or trouble) to fire-alarm control unit. Detector address shall be accessible from fire-alarm control unit and shall be able to identify the detector's location within the system and its sensitivity setting.
4. Integral Visual-Indicating Lights: Provide both alarm and power LEDs, flashing under normal conditions. LEDs shall burn steady, controlled by the FACU, to indicate an alarm condition.
5. Base Mounting: Detector and associated electronic components shall be mounted in a twist-lock module that connects to a fixed base. Provide terminals in the fixed base for connection to building wiring. Provide terminals in the fixed base for connection of a remote alarm LED.
6. Self-Restoring: Detectors shall not require resetting or readjustment after actuation to restore them to normal operation.
7. Remote Control: Unless otherwise indicated, detectors shall be analog-addressable type, individually monitored at fire-alarm control unit for calibration, sensitivity, and alarm condition and individually adjustable for sensitivity by fire-alarm control unit.
8. Test Means: Provide a means to simulate an alarm condition and report to the FACU. Test shall be initiated at the detector (activation of a magnetic switch) or initiated remotely on command from the FACU when in "test" condition.

9. Detectors shall store an identifying device type code for FACU identification of devices as either ION, PHOTO, or THERMAL.

B. Photoelectric Smoke Detectors:

1. Use photoelectric / light scattering principal to measure smoke density and send data to the FACU representing analog level of smoke density.
2. An operator at fire-alarm control unit, having the designated access level, shall be able to manually access the following for each detector:
 - a. Primary status.
 - b. Device type.
 - c. Present average value.
 - d. Present sensitivity selected.
 - e. Sensor range (normal, dirty, etc.).

2.6 HEAT DETECTORS

A. General Requirements for Heat Detectors:

1. Comply with UL 521.
2. Integral Addressable Module: Arranged to communicate detector status (normal, alarm, or trouble) to fire-alarm control unit. Detector address shall be accessible from fire-alarm control unit and shall be able to identify the detector's location within the system and its sensitivity setting.
3. Integral Visual-Indicating Lights: Provide both alarm and power LEDs, flashing under normal conditions. LEDs shall burn steady, controlled by the FACU, to indicate an alarm condition.
4. Base Mounting: Detector and associated electronic components shall be mounted in a twist-lock module that connects to a fixed base. Provide terminals in the fixed base for connection to building wiring. Provide terminals in the fixed base for connection of a remote alarm LED.
5. Use electronic sensor to measure thermal conditions caused by fire and send data to the FACU representing analog level of such thermal conditions.

B. Heat Detector, Combination Type:

1. Actuated by either a fixed temperature of 135 deg F or a rate of rise that exceeds 15 deg F per minute unless otherwise indicated.
2. Fixed-temperature sensing shall be independent of rate-of-rise sensing.
3. Mounting: Twist-lock base interchangeable with smoke-detector bases.
4. Integral Addressable Module: Arranged to communicate detector status (normal, alarm, or trouble) to fire-alarm control unit.

C. Heat Detector, Fixed-Temperature Type: Actuated by temperature that exceeds a fixed temperature of 194 deg F.

1. Mounting: Twist-lock base interchangeable with smoke-detector bases.

2.7 NOTIFICATION APPLIANCES

- A. General Requirements for Notification Appliances: Connected to notification appliance signal circuits, equipped for mounting as indicated and with screw terminals for system connections.
 - 1. Combination Devices: Factory-integrated audible and visible devices in a single-mounting assembly, equipped for mounting as indicated and with screw terminals for system connections. Comply with requirements for both visual and audible notification appliances.
- B. Visible Notification Appliances (Strobes):
 - 1. Xenon strobe lights complying with UL 1971, 24-V dc nominal.
 - 2. Rated Light Output: 15/30/75/110 cd, selectable in the field.
 - 3. Flashing shall be in a temporal pattern, synchronized with other units. Maximum pulse duration: 0.2 seconds.
 - 4. Clear or nominal white polycarbonate lens mounted on an aluminum faceplate. The word "FIRE" shall be engraved in minimum 1-inch high letters on the lens.
 - 5. For units with guards to prevent physical damage, light output ratings shall be determined with guards in place.
 - 6. Strobe Leads: Factory connected to screw terminals.
 - 7. Mounting Faceplate: Factory finished, red.
- C. Audible Notification Appliances (Horns / Sounders):
 - 1. Electric-vibrating-polarized type, 24-V dc nominal; with provision for housing the operating mechanism behind a grille.
 - 2. Provide an ANSI S3.41 three-pulse temporal pattern audible signal, synchronized.
 - 3. Horns shall produce a sound-pressure level of 90 dB, measured 10 feet from the horn, using the coded signal prescribed in UL 464 test protocol. Output sound level shall be 120 dB maximum.
 - 4. Devices located outdoors shall be listed for use in wet locations.
 - 5. Field programmable without the use of special tools.
- D. Bells: 10" diameter vibrating type, 24V dc nominal. Bells located outdoors shall be listed for use in wet locations.

2.8 ADDRESSABLE INTERFACE DEVICES

- A. Monitor Modules:
 - 1. For use in providing a system address for alarm-initiating devices for wired applications with normally open dry contacts.
 - 2. Provide an LED that flashes under normal conditions, indicating that the monitor module is operational and in regular communication with the FACU.
 - 3. Modules installed in non-conditioned spaces shall be tested, listed, and marked for continuous duty across the range of temperatures and humidity expected at their installed locations.
- B. Control Modules:

1. For use in auxiliary control functions, operating as a dry contact relay.
2. Typical equipment control functions would include direct signals to: an elevator controller to initiate elevator recall, to a circuit-breaker shunt trip for power shutdown, or to a lighting control system for lighting control scenario under fire alarm conditions.
3. For use in supervising and controlling the operation of one NAC.
4. Provide an LED that flashes under normal conditions, indicating that the monitor module is operational and in regular communication with the FACU.

2.9 DIGITAL ALARM COMMUNICATOR TRANSMITTER (DACT)

- A. Digital alarm communicator transmitter, 4-channel minimum, shall be compatible with and acceptable to the remote central station and shall comply with UL 632 and be listed and labeled by an NRTL.
- B. Functional Performance:
 1. Unit shall receive an alarm, supervisory, or trouble signal from fire-alarm control unit and automatically capture two telephone line(s) and dial a preset number for a central station, remote supervising station, or proprietary supervising station.
 2. When contact is made with central station(s), signals shall be transmitted. If service on either line is interrupted for longer than 45 seconds, transmitter shall initiate a local trouble signal and transmit the signal indicating loss of telephone line to the remote alarm receiving station over the remaining line.
 3. Transmitter shall automatically report telephone service restoration to the central station. If service is lost on both telephone lines, transmitter shall initiate the local trouble signal.
 4. Precedence of signals transmitted to the supervising station shall be: (1) Fire Alarm, (2) Supervisory Signal, (3) Trouble Signal, (4) Security Alarm.
- C. Local functions and display at the digital alarm communicator transmitter shall include the following:
 1. Verification that both telephone lines are available.
 2. Programming device.
 3. LED display.
 4. Manual test report function and manual transmission clear indication.
 5. Communications failure with the central station or fire-alarm control unit.
- D. Digital data transmission shall include the following:
 1. Address of the alarm-initiating device.
 2. Address of the supervisory signal.
 3. Address of the trouble-initiating device.
 4. Loss of ac supply or loss of power.
 5. Low battery.
 6. Abnormal test signal.
 7. Communication bus failure.
- E. Secondary Power: Integral rechargeable battery and automatic charger.

- F. Self-Test: Conducted automatically every 24 hours with report transmitted to central station.
- G. In lieu of a DACT, an addressable network is acceptable for signal transmission. If other means of signal transmission may be necessary, coordinate suitability with the AHJ.

2.10 SURGE PROTECTION

- A. AC Input:
 - 1. Mount in listed enclosure adjacent to branch circuit panelboard. Wind small coil (5 to 10 turns) in branch circuit conductor just downstream of the suppressor connection.
 - 2. Install feed through branch circuit transient suppressor (Ditek #DTK-120S20A, Leviton #51020-WM/DIN, or approved equivalent that is UL 1449 2nd Edition Listed).
- B. DC Circuits Extending Outside Building:
 - 1. Mount inside the building, near the point of entry to or exit from each building in a labeled enclosure.
 - 2. Provide "pi"-type filter on each conductor, consisting of primary arrestor, series impedance, and fast-acting secondary arrestor that clamps at 30-40V.
 - 3. A minimum of 36" of conductor length shall be provided between the "pi"-type filter and the first system device in the building.
- C. Acceptable Models: Citel America #B280-24V, Ditek #DTK-2MHLP24B, Northern Technologies #DLP-42, Simplex #2081-9027/9028, Transtector #TSP8601.

2.11 WATER FLOW SWITCHES

- A. Flow switches shall be integral, mechanical, non-coded, non-accumulative retard type.
- B. Flow switches shall have an alarm transmission delay that is adjustable from 0 to 60 seconds. Initial settings shall be 30 to 45 seconds.
- C. Flow switches shall be located a minimum of one foot from any fitting that changes the direction of flow and a minimum of 3 feet from a valve, as required by NFPA 13.
- D. Flow switches shall be furnished and installed by the Mechanical/Sprinkler Contractor. The Electrical/Fire Alarm Contractor shall make electrical connections.

2.12 VALVE SUPERVISORY SWITCHES

- A. Supervisory switch mechanisms shall be contained in weatherproof housings with ¾" tapped conduit entrance fittings and hardware for attachment to the valves. Switch housings shall be finished in red, baked enamel paint.
- B. Mount switches to not interfere with normal operation of the valves. Adjust switches to operate within two revolutions toward the closed position of the valve control, or when

the stem of the valve has moved no more than one-fifth of the distance from its normal position.

2.13 REMOTE ANNUNCIATOR

- A. Description: Annunciator functions utilizing an alphanumeric display and LED indicating lights shall match those of fire-alarm control unit for alarm, supervisory, and trouble indications. Manual control functions shall match those of fire-alarm control unit; including acknowledge, silence, reset, and test for alarm supervisory, and trouble signals.
1. Mounting: Flush cabinet, NEMA 250, Type 1.
 2. Alarm signal with alarm resound feature.
 3. Communication via two-wire EIA-485 interface.
 4. The fire alarm system shall be capable of supporting a minimum of four remote annunciators.

2.14 SNAP EDGE FRAMES

- A. Description: Mountable Front Load Easy Open Snap Frame
1. Outside edges flip open for quick document changes.
 2. Non-glare plastic cover.
 3. Design Basis: U-Line #S-2132 Series.
 4. For use with operator's instructions and device map.

PART 3 - EXECUTION

3.1 EQUIPMENT INSTALLATION

- A. Comply with NFPA 72 for installation of fire-alarm equipment.
- B. Equipment and Device Mounting:
1. Install fire-alarm control unit with tops of cabinets not more than 72 inches above the finished floor.
 2. Install equipment and devices securely attached to walls, ceilings, floors, building structure. Hardware and supports shall be suitable for the load supported. Ceiling mounted devices shall not be supported solely by suspended ceilings.
 3. Comply with requirements for seismic-restraint devices specified in Section "Vibration and Seismic Controls for Electrical Systems."
- C. Smoke- or Heat-Detector Spacing:
1. Comply with NFPA 72, "Smoke-Sensing Fire Detectors" Section in the "Initiating Devices" Chapter, for smoke-detector spacing.
 2. Comply with NFPA 72, "Heat-Sensing Fire Detectors" Section in the "Initiating Devices" Chapter, for heat-detector spacing.
 3. HVAC: Locate detectors not closer than 3 feet (1 m) from air-supply diffuser or return-air opening.
 4. When installed in a room, orient so that the alarm LED is visible from the nearest door to the corridor.

D. Detector Protection:

1. Unless suitably protected from dust, paint, etc.; detectors shall not be installed until final construction clean-up is complete. If contaminated, detectors shall be replaced.
2. Where accidental damage or deliberate abuse is anticipated, provide a protective guard that is listed for use with the detector and is acceptable to the AHJ.

E. Audible Alarm-Indicating Devices: Unless ceiling mounted, install not less than 6 inches below the ceiling. Install horns on flush-mounted back boxes with the device-operating mechanism concealed behind a grille.

F. Visible Alarm-Indicating Devices: Install adjacent to each alarm bell or alarm horn; and unless ceiling mounted, install at least 6 inches below the ceiling.

G. Device Location-Indicating Lights: Locate in public space near the device they monitor.

H. Annunciator: Install with top of panel not more than 72 inches above the finished floor.

I. Control Selector Switches:

1. Toggle switches with LED status indicator lights.
2. Hand in "up" position with amber LED. Auto in "center" position with green LED. Off in "down" position with red LED.

3.2 CONNECTIONS

A. Make addressable connections with a supervised interface device to the following devices and systems and any others indicated on the drawings. Install the interface device less than 3 feet from the device controlled. Make an addressable confirmation connection when such feedback is available at the device or system being controlled.

1. Supervisory connections at sprinkler system flow and valve supervisory switches. Water flow alarms shall be configured by sprinkler zone, not to exceed one floor.
2. Supervisory connections at low-air-pressure switch of each dry-pipe sprinkler system.

B. Sprinkler system supervisory circuits for monitoring flow, valve position, air pressure, water temperature, pump status, etc. shall initiate distinct audible and visual indications at the FACU. The audible signal shall either be a 4" diameter bell or a pulsing piezo-electric alarm. Provide an engraved label adjacent to the bell/alarm indicating "SPRINKLER STATUS ABNORMAL". If only sprinkler valve position is supervised, engraved label shall indicate "SPRINKLER VALVE CLOSED".

3.3 REMOTE ALARM TRANSMISSION

A. The Contractor shall program the DACT, connect telephone lines, coordinate signal transmission with the supervising station, and verify proper signal receipt by the supervising station.

3.4 IDENTIFICATION

- A. Identify system components, wiring, cabling, and terminals. Comply with requirements for identification specified in Section "Identification for Electrical Systems."
- B. Detectors, appliances, and modules shall be labeled with unique numbers that are indicated on as-built drawings and permanently mounted on device bases. Labels shall be legible from floor level. Detectors shall be labeled uniquely and sequentially starting at the FACU with both SLC and device designations. Labels shall be printed black lettering on clear background and attached to the device base.
- C. Junction and pull box covers shall be labeled to indicate the circuits or function of the conductors contained in the boxes. Labels shall be neatly applied with black lettering on clear background.
- D. Conductors shall be labeled with permanent wire markers at connections at the FACU, other control equipment, power supplies, and terminal cabinets.
- E. Install framed basic operating instructions in a location visible from fire-alarm control unit. Optionally, with Owner concurrence, the instructions may be affixed to the inside of the FACU door.
- F. Floor plans of the fire alarm system installation shall be provided at the FACU.
 - 1. Provide a locked box adjacent to the FACU for plan book storage. Key to match FACU. Label lock box.
 - 2. Floor plans shall include device locations and addresses. Indicate equipment, module, and EOL locations.
 - 3. Provide a legend for symbols used.
 - 4. A separate page shall be provided for each floor. Laminate individual pages and bind all pages in a book form.
- G. NFPA 72 Record of Completion documentation shall be kept inside the FACU, or its kept location shall be permanently indicated inside the FACU on an engraved label.
- H. At all equipment with a 120 VAC power source, provide an engraved label indicating panelboard ID, branch circuit number, and panelboard location. At the FACU, provide an additional engraved label inside the FACU.

3.5 GROUNDING

- A. Ground fire-alarm control unit and associated circuits; comply with IEEE 1100. Install a ground wire from main service ground to fire-alarm control unit.

3.6 FIELD QUALITY CONTROL

- A. Final field tests shall be witnessed by authorities having jurisdiction.
- B. Manufacturer's Field Service: Engage a factory-authorized service technician to make connections to the FACU; to program the system; to inspect, test, and adjust components, assemblies, and equipment installations, including connections.

C. Tests and Inspections:

1. Visual Inspection: Conduct visual inspection prior to testing.
 - a. Inspection shall be based on completed Record Drawings and system documentation that is required by NFPA 72 in its "Completion Documents, Preparation" Table in the "Documentation" Section of the "Fundamentals of Fire Alarm Systems" Chapter.
 - b. Comply with "Visual Inspection Frequencies" Table in the "Inspection" Section of the "Inspection, Testing and Maintenance" Chapter in NFPA 72; retain the "Initial/Reacceptance" column and list only the installed components.
2. Conductor Testing: All conductors shall be tested for grounds, opens and shorts prior to termination at panels and installation of detector heads. Conductors shall be megger tested for a minimum of 10 megohms from conductor to ground and conductor to conductor. Provide record of test results to Engineer in advance of acceptance inspection.
3. Test mounting and anchorage devices according to requirements in Section "Seismic Controls for Electrical Work." Prepare and provide test reports.
4. System Testing: Comply with "Test Methods" Table in the "Testing" Section of the "Inspection, Testing and Maintenance" Chapter in NFPA 72.
5. Test 100% of alarm initiating devices, all software functions, all other system functions including DACT communication, and verify system operational matrix. Notify Owner and Engineer 2 weeks in advance of this test to permit witness observation.
6. Print a System Status and Programming Report with settings for each alarm indicating device, the current sensitivity of each analog addressable smoke detector, and detailed system operational matrix.
7. Factory-authorized service representative shall prepare the "Fire Alarm System Record of Completion", NFPA 72, Figure 1-6.2.1 in the "Documentation" Section of the "Fundamentals of Fire Alarm Systems" Chapter in NFPA 72 and the "Inspection and Testing Form" in the "Records" Section of the "Inspection, Testing and Maintenance" Chapter in NFPA 72. Submit "Fire Alarm System Record of Completion" to Engineer for delivery to Owner.
8. After 100% system test and submission of "Fire Alarm System Record of Completion", request Engineer to schedule an AHJ acceptance inspection, a minimum of 2 days after completion of system testing.
9. For AHJ acceptance inspection, perform sampling testing as directed by AHJ for detectors and functional tests. Provide 2-way radios, ladders, smoke source, and other materials needed for testing the system.

D. Reacceptance Testing: Perform reacceptance testing to verify the proper operation of added or replaced devices and appliances.

E. Fire-alarm system will be considered defective if it does not pass tests and inspections.

F. Prepare test and inspection reports.

3.7 TRAINING / DEMONSTRATION

- A. Engage a factory-authorized service representative to train Owner's maintenance personnel for a minimum of 8 hours to adjust, operate, and maintain fire-alarm system. Training schedule must be coordinated to meet the Owner's schedule. Training location will be provided by the Owner.
- B. As a minimum, training shall cover:
 - 1. System software multiple access levels via password protection for accommodating Owner capability for disabling individual alarm inputs or normal outputs for alarms without modifying the system programming or affecting operation of the remainder of the system.
 - 2. Overall system concepts, capabilities, and functions. Training shall be of sufficient detail so that the Owner shall be able to remove any device from service and return to service without the need for the Manufacturer's approval or assistance.
 - 3. Methods and means of troubleshooting and replacement of all field wiring devices.
 - 4. Methods and means of troubleshooting the main FACU and field devices for programming, bussing systems, internal panel and unit wiring, circuitry, and interconnections.
 - 5. Preventative maintenance service techniques and schedules, including historical data trending of alarm and trouble records.
 - 6. Training documentation and actual system software used for training shall be provided in digital form and left with the Owner at the completion of training.
- C. Provide two bound copies of training information.

END OF SECTION 283111

SECTION 285000 – EMERGENCY RADIO COMMUNICATION ENHANCEMENT SYSTEM

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Specification Sections, apply to this Section.
- B. North Carolina State Highway Patrol document with information for Viper radio system call signs and locations of tower sites accessible within Brunswick County (attached for reference after this Section).

1.2 SUMMARY

- A. Section Includes:
 - 1. In-building radio signal amplification system for stage building only. Park support building does not require in-building radio signal amplification system.
 - 2. A system shall be provided to cover new stage building.

1.3 DEFINITIONS

- A. AHJ: Authority Having Jurisdiction
- B. BDA: Bi-Directional Amplifier: Device used to amplify band-selective or multi-band RF signals in the uplink, to the base station and in the downlink from the base station to subscriber devices for enhanced signals and improved coverage
- C. DAS: Distributed Antenna System
- D. FCC: Federal Communications Commission
- E. RF: Radio Frequency

1.4 ACTION SUBMITTALS

- A. RF Surveys / Shop Drawings: Measurement drawings of each floor of the building which indicate relative RF field strength for each frequency and band of interest. Submit to both the AHJ and the Engineer.
 - 1. Initial signal strength mapping. Perform an initial site survey to measure signal strength before construction starts.
 - 2. Pre-final signal strength mapping. Perform a site survey to measure signal strength near substantial completion of the building.
- B. Shop Drawings:
 - 1. Include plans and details for code compliant, UL Listed, DAS system design for emergency responder radio coverage.
- C. Product Data:
 - 1. Include bill of materials for all BDA / DAS equipment and components.
 - 2. Manufacturer product data sheets and cut sheets for all equipment and components.

- D. Manufacturer Seismic Qualification Certification: Submit certification that poles, accessories, and components will withstand seismic forces defined in Section "Seismic Controls for Electrical Work." Include the following:
 - 1. Basis of Certification: Indicate whether withstand certification is based on actual test of assembled components or on calculation.
 - a. The term "withstand" means "the unit will remain in place without separation of any parts from the device when subjected to the seismic forces specified after the seismic event."
 - 2. Dimensioned Drawings: Identify, locate, and describe mounting and anchorage provisions.
 - 3. Detailed description of equipment anchorage devices on which the certification is based and their installation requirements.

1.5 INFORMATIONAL SUBMITTALS

- A. Sample Warranty: Manufacturer's standard warranty.

1.6 CLOSEOUT SUBMITTALS

- A. RF Survey / Shop Drawings: Final installed measurement drawings of each floor of the building which indicate relative RF field strength for each frequency and band of interest.
- B. Operation and Maintenance Data: For all system equipment and components to include in emergency, operation, and maintenance manuals.

1.7 QUALITY ASSURANCE

- A. 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.

1.8 WARRANTY

- A. Special Warranty: Manufacturer agrees to repair or replace components that fail in materials or workmanship within a specified warranty period.
 - 1. Warranty Period: Two years from date of Final Completion.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Provide an in-building radio signal amplification system to provide complete coverage in the building for the public safety agencies. System shall meet the requirements of:
 - 1. The local AHJ.
 - 2. FCC.
 - 3. The North Carolina Fire Code.
 - 4. NFPA 72, National Fire Alarm and Signaling Code.
 - 5. NFPA 1221, Standard for the Installation, Maintenance, and Use of Emergency Services Communications Systems.
 - 6. UL 2524, Standard for In-building 2-Way Emergency Radio Communication Enhancement Systems.

- B. Seismic Performance: System equipment and components shall withstand the effects of earthquake motions.

PART 3 - EXECUTION

3.1 RF FIELD SURVEYS

- A. Perform initial field survey to determine that a system is required due to inadequate radio signal coverage.
- B. Perform pre-design field surveys to determine signal strength data required to perform designs.

3.2 EXAMINATION

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

3.3 INSTALLATION

- A. Install system equipment and components.
- B. Coordinate infrastructure needs for system installation.

3.4 IDENTIFICATION

- A. Identify and mark equipment and components with engraved labels as specified in Section "Electrical Identification".

3.5 FIELD QUALITY CONTROL

- A. Manufacturer's Field Service: Engage a factory-authorized service representative to:
 - 1. Test and adjust equipment and components.
 - 2. Perform startup and commissioning of system.
- B. Tests and Inspections:
 - 1. Perform final testing for the local inspection authority, including final signal strength mapping.
 - 2. Perform final testing and demonstration with the AHJ.
 - 3. Submit final signal strength mapping results shop drawings.

END OF SECTION 285000

SECTION 316219 - TIMBER PILES

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 round timber piles.

1.3 UNIT PRICES

- A. Contract Sum: Base Contract Sum on number and dimensions of piles indicated from tip to driving grade, plus not less than 12 inches of overlength for cutting piles at cutoff elevations.
- B. Work of this Section is affected as follows:
 - 1. Additional payment for pile lengths in excess of that indicated, and credit for pile lengths less than that indicated, is calculated at unit prices stated in the Contract, based on net addition or deduction to total pile length as determined by Architect and measured to nearest 12 inches.
 - a. Additional payment for splices required to extend pile lengths in excess of that indicated is calculated at unit prices stated in the Contract.
 - 2. Additional payment for number of piles in excess of that indicated, and credit for number of piles less than that indicated, is calculated at unit prices stated in the Contract.
 - 3. Unit prices include labor, materials, tools, equipment, and incidentals for furnishing, driving, cutting off, capping, and disposing of cutoffs.
 - 4. Test piles that become part of permanent foundation system are considered as an integral part of the Work.
 - 5. No payment is made for rejected piles, including piles driven out of tolerance, defective piles, or piles damaged during handling or driving.

1.4 PREINSTALLATION MEETINGS

- A. Preinstallation Conference: Conduct conference at project site.

1.5 ACTION SUBMITTALS

- A. Product Data: For each type of product.
- B. Shop Drawings: For timber piles. Show fabrication and installation details for piles, including details of driving shoes, tips or boots, uplift anchors, and pile butt protection.

1. Include arrangement of static pile reaction frame, test and anchor piles, equipment, and instrumentation. Submit structural analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

1.6 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For Installer, Professional Engineer, and Testing Agency.
- B. Round timber pile treatment data as follows, including chemical treatment manufacturer's written instructions for handling, storing, installing, and finishing treated material:
 1. For each type of preservative-treated timber product, include certification by treating plant stating type of preservative solution and pressure process used, net amount of preservative retained, and compliance with applicable standards.
 2. For waterborne-treated products, include statement that moisture content of treated materials was reduced to levels indicated before shipment to Project site.
- C. Pile-Driving Equipment Data: Include type, make, and rated energy range; weight of striking part of hammer; weight of drive cap; and, type, size, and properties of hammer cushion.
- D. Pile Test Reports: Use Pile Driving Analyzer System (PDA).
- E. Pile-Driving Records: Submit within three days of driving each pile.
- F. Certified Piles Survey: Submit within seven days of pile driving completion.
- G. Field quality-control reports.
- H. Material Certificates: For preservative-treated piles. Indicate type of preservative used and net amount of preservative retained.
- I. Preconstruction Photographs: Photographs or video of existing conditions of adjacent construction. Submit before the Work begins.

1.7 QUALITY ASSURANCE

- A. Installer Qualifications: An authorized representative who is trained and approved by manufacturer.
 1. Installer's responsibility includes engaging a qualified professional engineer to prepare pile-driving records.
- B. Testing Agency Qualifications: Qualified according to ASTM E 329 for testing indicate and accredited by IAS or ILAC Mutual Recognition Arrangement as complying with ISO/IEC 17025.

1.8 PRECONSTRUCTION TESTING

- A. General: Pile Driving Analyzer System (PDA).are used to verify driving criteria and pile lengths and to confirm allowable load of piles.
 1. Furnish test piles same length longer than production piles.
 2. Determination of actual length of piles is based on results of static pile tests.

- B. Pile Tests: Use Pile Driving Analyzer System (PDA).
- C. Drive test piles at locations indicated to the minimum penetration or driving resistance indicated. Use test piles identical to those required for Project, and drive with appropriate pile-driving equipment operating at rated driving energy to be used in driving permanent piles.
 - 1. Pile Design Load:
 - a. Compression: 50 kips.
 - b. Tension/uplift: 20 kips. Use Pile Driving Analyzer System (PDA) values for tension capacity.
 - c. Lateral: 3.5 kips. Use L-Pile analysis for lateral capacity.
- D. Approval Criteria: Allowable load shall be the load acting on the test pile divided by a factor of safety of 2.:
 - 1. Net settlement, after deducting rebound, of not more than 0.01 inch/ton of test load.
 - 2. Total settlement exceeds the pile elastic compression by 0.15 inch, plus 1.0 percent of the tip diagonal dimension.
 - 3. A plunging failure or sharp break in the load settlement curve.
- E. Test Pile-Driving Records: Prepare driving records for each test pile, compiled and attested to by a qualified professional engineer. Include same data as required for driving records of permanent piles.
- F. Test piles that comply with requirements, including location tolerances, may be used on Project.

1.9 DELIVERY, STORAGE, AND HANDLING

- A. Deliver piles to Project site in such quantities and at such times to ensure continuity of installation. Handle and store piles at Project site to prevent breaks, cuts, abrasions, or other physical damage and as required by AWP4 M4.
 - 1. Do not drill holes or drive spikes or nails into pile below cutoff elevation.

1.10 FIELD CONDITIONS

- A. Protect structures, underground utilities, and other construction from damage caused by pile driving.
- B. Site Information: A geotechnical report has been prepared for this Project and is referenced elsewhere in the Project Manual for information only.
- C. Preconstruction Photographs: Inventory and record the condition of adjacent structures, underground utilities, and other construction. Document conditions that might be misconstrued as damage caused by pile driving. Comply with Section 013233 "Photographic Documentation."

PART 2 - PRODUCTS

2.1 TIMBER PILES

- A. Round Timber Piles: ASTM D 25, unused, clean peeled, one piece from butt to tip; of the following species and size basis:

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include the following:
 - a. Hayward Baker.
 2. Species: Southern yellow pine..
 3. Size Basis: 8" minimum tip diameter natural taper.
- B. Pressure-treat round timber piles according to AWP A U1 as follows:
1. Service Condition: UC5C Marine Use Southern Waters.
 2. Treatment: 0.8 lbs/ft³ CCA Treatment.

2.2 PILE ACCESSORIES

- A. Driving Shoes: Fabricate from ASTM A 1011/A 1011M, hot-rolled carbon-steel strip to suit pile-tip diameter, of the following type and thickness, and secure to pile tip so as to not affect pile alignment during driving:
1. Type: Flat boot, Arrow point.
 2. Thickness: 1/4 inch.

2.3 FABRICATION

- A. Pile Tips: Cut and shape pile tips to accept driving shoes. Fit and fasten driving shoes to pile tips according to manufacturer's written instructions.
- B. Pile Butt: Trim pile butt and cut perpendicular to longitudinal axis of pile. Chamfer and shape butt to fit tightly to driving cap of hammer.
- C. Field-Applied Wood Preservative: Treat field cuts, holes, and other penetrations according to AWP A M4.
1. Coal-tar roofing cement for treating drilled holes or sealing cutoffs shall be free of asbestos.
- D. Pile Splices: Splices are not permitted.
- E. Pile-Length Markings: Mark each pile with horizontal lines at 12-inch intervals; label the distance from pile tip at 60-inch intervals. Maintain markings on piles until driven.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Site Conditions: Do not start pile-driving operations until earthwork fills have been completed or excavations have reached an elevation of 6 to 12 inches above bottom of footing or pile cap.

3.2 DRIVING EQUIPMENT

- A. Pile Hammer: Air-, steam-, hydraulic-, or diesel-powered type capable of consistently delivering adequate peak-force duration and magnitude to develop the ultimate capacity required for type and size of pile driven and character of subsurface material anticipated.
- B. Hammer Cushions and Driving Caps: Between hammer and top of pile, provide hammer cushion and steel driving cap as recommended by hammer manufacturer and as required to drive pile without damage.
- C. Leads: Use fixed, semifixed, or hanging-type pile-driver leads that hold the full length of pile firmly in position and in axial alignment with hammer.

3.3 DRIVING PILES

- A. General: Continuously drive piles to elevations or penetration resistance indicated or established by static load testing of piles. Establish and maintain axial alignment of leads and piles before and during driving.
- B. Spudding: Drive spud piles through overlying highly resistant strata or obstructions and withdraw for reuse.
- C. Predrilling: Provide pre-excavated holes where indicated, to depths indicated. Drill holes with a diameter less than the largest cross-section dimension of pile.
 - 1. Firmly seat pile in predrilled hole by driving with reduced energy before starting final driving.
- D. Driving Tolerances: Drive piles without exceeding the following tolerances, measured at pile heads:
 - 1. Location: 4 inches from location indicated after initial driving, and 6 inches after pile driving is completed.
 - 2. Plumb: Maintain 1 inch in 48 inches from vertical, or a maximum of 4 inches, measured when pile is aboveground in leads.
 - 3. Batter Angle: Maximum 1 inch in 48 inches from required angle, measured when pile is aboveground in leads.
- E. Withdraw damaged or defective piles and piles that exceed driving tolerances, and install new piles within driving tolerances.
 - 1. Fill holes left by withdrawn piles using cohesionless soil material such as gravel, broken stone, and gravel-sand mixtures. Place and compact in lifts not exceeding 72 inches..
 - 2. Fill holes left by withdrawn piles as directed by Architect.
- F. Abandon and cut off rejected piles as directed by Architect. Leave rejected piles in place and install new piles in locations as directed by Architect.
- G. Cut off butts of driven piles square with pile axis and at elevations indicated.
 - 1. Cover cut-off piling surfaces with caps overlapping pile end by minimum 2 inches.
- H. Pile-Driving Records: Maintain accurate driving records for each pile, compiled and attested to by a qualified professional engineer. Include the following data:
 - 1. Project name and number.
 - 2. Name of Contractor.

3. Pile species.
4. Pile location in pile group and designation of pile group.
5. Sequence of driving in pile group.
6. Pile dimensions.
7. Ground elevation.
8. Elevation of tips after driving.
9. Final tip and cutoff elevations of piles after driving pile group.
10. Records of redriving.
11. Elevation of splices.
12. Type, make, model, and rated energy of hammer.
13. Weight and stroke of hammer.
14. Type of pile-driving cap used.
15. Cushion material and thickness.
16. Actual stroke and blow rate of hammer.
17. Pile-driving start and finish times, and total driving time.
18. Time, pile-tip elevation, and reason for interruptions.
19. Number of blows for every 12 inches of penetration, and number of blows per 1 inch for the last 6 inches of driving.
20. Pile deviations from location and plumb.
21. Preboring, jetting, or special procedures used.
22. Unusual occurrences during pile driving.

- I. Certified Piles Survey: Engage a professional licensed land surveyor to prepare a piles survey showing final location of piles in relation to the property survey and existing benchmarks.

1. Notify Architect when deviations from locations exceed allowable tolerances.

3.4 FIELD QUALITY CONTROL

- A. Special Inspections: Owner will engage a qualified special inspector to perform the following special inspections:
 1. Timber piles.
- B. Testing Agency: Owner will engage a qualified testing agency to perform tests and inspections.
- C. Tests and Inspections:
 1. Dynamic Pile Testing: High-strain dynamic monitoring shall be performed and reported according to ASTM D 4945 during initial driving and during restriking on five per cent of the piles.

3.5 DISPOSAL

- A. Remove withdrawn piles and cutoff sections of piles from site and legally dispose of them off Owner's property.

END OF SECTION 316219

SECTION 323119 - ORNAMENTAL METAL FENCES AND GATES

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Metal plate frames with stainless steel wire infill forming fences and gates.
- B. Related Documents and Sections: Examine Contract Documents for requirements that directly affect or are affected by Work of this Section. Other Documents and Sections that directly relate to work of this Section include, but are not limited to:
 - 1. General provisions of the Contract, including General and Supplementary Conditions, and Division 01 General Requirements Specification Sections.
 - 2. Section 033000 - CAST-IN-PLACE CONCRETE.
 - 3. Section 057300 - DECORATIVE METAL RAILINGS.
- C. Delegated Design: Work of this Section is subject to Delegated Design requirements described in Division 01.
 - 1. Design work of this Section subject to gravity, seismic loads, and design loads, including comprehensive engineering analysis by a qualified professional engineer, using performance requirements and design criteria indicated.

1.2 SYSTEM DESCRIPTION

- A. Contractor's Design:
 - 1. Engage the services of a Professional Engineer registered in the State of North Carolina to prepare complete shop drawings and structural design computations for work of this Section. Drawings and calculations shall bear the engineer's professional seal and signature.
 - a. Note: Manufacturer's shop drawings stamped by the engineer are acceptable instead of those actually prepared by the engineer.
 - 2. The structural design computations shall provide a complete structural analysis of all typical and special conditions of construction. Show how design load requirements and other performance criteria have been satisfied and conform to the governing laws and building codes.
 - 3. The shop drawings shall show all pertinent details for fabrication and erection of each metal fabrication indicated. Include plans, elevations, sections, and details of metal fabrications and their connections. Show anchorage and accessory items.
 - 4. Provide templates for anchors and bolts specified for installation under other Sections.

1.3 SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Shop Drawings: Include plans, elevations, sections, details, and attachments to other work demonstrating compliance with delegated design calculations,
- C. Calculations: Where installed work is indicated to comply with certain design loadings, provide professionally prepared calculations, material properties, certification, and other information required for structural analysis of performance of work.
- D. Samples: For each fence material and for each color specified.
 - 1. Provide Samples 12 inches in length for linear materials.
 - 2. Provide Samples 12 inches square for wire mesh materials.
- E. Welding certificates.

1.4 QUALITY ASSURANCE

- A. Installer Qualifications: Fabricator of products.
- B. Engineering: Provide the services of a Professional Engineer, currently registered in the State of North Carolina, to design and certify that the work of this section meets or exceeds the performance requirements specified in this section.
- C. Welding Qualifications: Qualify procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code - Steel."
- D. Mockups: Build mockups to set quality standards for fabrication and installation.
 - 1. Include 10-foot length of fence complying with requirements.
 - 2. Approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.
- E. Preinstallation Conference: Conduct conference at Project site.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Wind Loading:
 - 1. Fence Height: As indicated in the Drawings.
 - 2. Wind Exposure Category: C
 - 3. Design Wind Speed: 130 mph.

2.2 STEEL AND IRON

- A. Plates, Shapes, and Bars: ASTM A 36/A 36M. Tubing: ASTM A 500, cold formed steel

tubing.

- B. Castings: Either gray or malleable iron unless otherwise indicated.

1. Gray Iron: ASTM A 48/A 48M, Class 30.
2. Malleable Iron: ASTM A 47/A 47M.

2.3 STAINLESS STEEL

- A. Castings: ASTM A 743/A 743M, Grade CF 8 or CF 20.
- B. Sheet, Strip, Plate, and Flat Bar: ASTM A 666, Type 304.
- C. Bars and Shapes: ASTM A 276, Type 304.

2.4 WIRE ROPE

- A. Material: ASTM A 492 and ASTM A 555, Type 316 stainless steel. Fabricate wire rope with integral colored filament designating specific manufacturer.
- B. Length: Provide wire rope tendons in lengths indicated on accepted shop drawings.
1. Provide optimum adjustment in both directions by calculating final tendon lengths with allowance for tensioning fittings with 2/3 open and with 1/3 of thread length engaged.
 2. Measure tendon length from center of pin to center of pin, or center of eye to center of eye.

2.5 MOUNTING SPACERS/BRACKETS

- A. Provide wall mounting spacers, brackets and fittings required for attachment and connection to the structure and for support of stainless steel wire rope, wire netting, and metal rod as indicated on the Drawings.
- B. Mounting Types: Fabricate from AISI Type 316 and 316L stainless steel complying with ASTM F 1145. Provide sizes and types as required to meet project design conditions specified and indicated on Drawings.

2.6 FITTINGS AND CONNECTORS

- A. Provide fittings and connectors required for decorative metal railings and for attachment and connection of stainless steel wire rope, wire netting and metal rods to support framework and substrates.
- B. Types: Fabricate from AISI Type 316 and 316L stainless steel complying with ASTM F 1145. Provide sizes and types as required to meet project design conditions specified and indicated on Drawings and reviewed shop drawings including:
1. Shop applied swaged rope ends: Threaded external and internal swivel ends, turnbuckles, tensioning screws, end stops, clevis ends, eye ends, loop ends, and end cones.

2. Screwed rope ends for on-site assembly: Threaded external and internal swivel ends, turnbuckles, tensioning screws, end stops, clevis ends, eye ends, loop ends, and end cones.
 3. Clamps: Ring clamps, cross clamps, wire rope clamping cones, and connecting wire rope clamps.
 4. Post fittings: Straight, angled, and spherical
 5. Anchoring systems: Studs, clevis, eye end, eye bolt, slotted, spacer baskets, radial clevis holder, cross clamp with support disk, slotted rope deflector, ball cage.
- C. Accessories: Provide threaded couplings, tensioning screws, cover disks, eye bolts, eye nuts, carabineers, shackles, clips, welded rings, screws, washers, lock nuts, hexagonal nuts, dome nuts, wall anchors, screws, and wire end caps as required to complete the installation.

2.7 MISCELLANEOUS MATERIALS

- A. Welding Rods and Bare Electrodes: Select according to AWS specifications for metal alloy welded.
- B. Concrete: Normal-weight, air-entrained, ready-mix concrete complying with requirements in Section 033000 - CAST-IN-PLACE CONCRETE with a minimum 28-day compressive strength of 3000 psi, 3-inch slump, and 1-inch maximum aggregate size.
- C. Nonshrink Grout: Factory-packaged, nonstaining, noncorrosive, nongaseous grout complying with ASTM C 1107 and specifically recommended by manufacturer for exterior applications.

2.8 FENCES

- A. Posts:
1. Line Posts: Flat posts hot-dip galvanized after fabrication.
 2. End and Corner Posts: Square tubes formed from 0.108-inch nominal- thickness, metallic-coated steel sheet or formed from 0.105-inch nominal-thickness steel sheet and hot-dip galvanized after fabrication.
- B. Post Caps: Formed from steel sheet and hot-dip galvanized after forming.
- C. Rails: Square tubes.
1. Size: 1-3/8 by 1-1/2 inches or 1-1/2 by 1-1/2 inches.
 2. Metal and Thickness: 0.079-inch nominal-thickness, metallic-coated steel sheet or 0.075-inch nominal-thickness, uncoated steel sheet, hot-dip galvanized after fabrication.
- D. Fasteners: Manufacturer's standard tamperproof, corrosion-resistant, color-coated fasteners matching fence components with resilient polymer washers or clips.
- E. Galvanizing: For components indicated to be galvanized and for which galvanized coating is not specified, hot-dip galvanize to comply with ASTM A 123/A 123M. For hardware

items, hot- dip galvanize to comply with ASTM A 153/A 153M.

- F. Finish: Powder coating, custom color as selected by the Architect.

2.9 SWING GATES

- A. Gate Configuration: As indicated.
- B. Gate Frame Height: As indicated.
- C. Gate Opening Width: As indicated.
- D. Finish: Powder coating, custom color as selected by the Architect.

2.10 STEEL FINISHES

- A. Surface Preparation: Clean surfaces according to SSPC-SP 6/NACE No. 3, "Commercial Blast Cleaning."
- B. Powder Coating: Immediately after cleaning, apply 2-coat finish consisting of epoxy primer and TGIC polyester topcoat, with a minimum total dry film thickness of not less than 8 mils. Comply with coating manufacturer's written instructions.
 - 1. Color and Gloss: As selected by Architect from manufacturer's full range.

2.11 STAINLESS-STEEL FINISHES

- A. After fabrication, clean and de-scale stainless steel wire rope, fittings, and other components in accordance with ASTM A 380.
- B. Finish components with AISI No. 4 brushed satin finish in accordance with ASTM B 912.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine areas and conditions, with Installer present, for compliance with requirements for site clearing, earthwork, pavement work, construction layout, and other conditions affecting performance of the Work.
- B. Do not begin installation before final grading is completed unless otherwise permitted by the Architect.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Stake locations of fence lines, gates, and terminal posts. Do not exceed intervals of 500 feet or line of sight between stakes. Indicate locations of utilities, lawn sprinkler system,

underground structures, benchmarks, and property monuments.

3.3 DECORATIVE FENCE INSTALLATION

- A. Install fences according to manufacturer's written instructions. Install fence, sliding and swing gates with panel wire sides facing loading dock or ramp walking surface
- B. Install fences by setting posts as indicated and fastening rails and infill panels to posts. Peen threads of bolts after assembly to prevent removal.
- C. Post Excavation: Drill holes for posts in firm, undisturbed soil. Excavate holes to a diameter of not less than 4 times post size and a depth of not less than 24 inches plus 3 inches for each foot or fraction of a foot that fence height exceeds 4 feet.
- D. Post Setting: Set posts in concrete at indicated spacing into firm, undisturbed soil.
 - 1. Verify that posts are set plumb, aligned, and at correct height and spacing, and hold in position during setting with concrete or mechanical devices.
 - 2. Concrete Fill: Place concrete around posts and sleeves and vibrate or tamp for consolidation. Protect aboveground portion of posts from concrete splatter.
 - a. Exposed Concrete: Extend 2 inches above grade. Finish and slope top surface to drain water away from post.
 - 3. Posts Set in Concrete: Extend post to within 6 inches of specified excavation depth, but not closer than 3 inches to bottom of concrete.

3.4 GATE INSTALLATION

- A. Install gates according to manufacturer's written instructions, level, plumb, and secure for full opening without interference. Attach hardware using tamper-resistant or concealed means. Install ground-set items in concrete for anchorage. Adjust hardware for smooth operation and lubricate where necessary.

3.5 ADJUSTING

- A. Gates: Adjust gates to operate smoothly, easily, and quietly, free of binding, warp, excessive deflection, distortion, nonalignment, misplacement, disruption, or malfunction, throughout entire operational range. Confirm that latches and locks engage accurately and securely without forcing or binding.
- B. Lubricate hardware and other moving parts.

3.6 WASTE MANAGEMENT

- A. Separate and dispose of waste in accordance with the Project's Waste Management Plan.

END OF SECTION