HENRY COUNTY AIRPORT
Hampton, Georgia
Project No. 103620
Bidding Documents

ARCHITECT
The Architecture Group, Inc.
381 Venable Street
Atlanta, Georgia 30313
(678)222-0375

STRUCTURAL ENGINEER
PES Structural Engineers
1852 Century Place, Suite 201
Atlanta, Georgia 30345
(770)457-5923

MECHANICAL, ELECTRICAL, PLUMBING ENGINEERS
Spencer Bristol Engineering
3577 Parkway Lane, Suite 250
Norcross, Georgia 30092
(770)414-1628
# TABLE OF CONTENTS

<table>
<thead>
<tr>
<th>SECTION NUMBER</th>
<th>SECTION TITLE</th>
</tr>
</thead>
<tbody>
<tr>
<td>DIVISION 00 - PROCUREMENT AND CONTRACTING REQUIREMENTS</td>
<td>Refer to: CMGC Construction Contract (w/General Conditions)</td>
</tr>
<tr>
<td>DIVISION 01 - GENERAL REQUIREMENTS</td>
<td>01 4150 Special Inspections</td>
</tr>
<tr>
<td>DIVISION 02 - EXISTING CONDITIONS</td>
<td>02 8200 Hazardous Material Procedures</td>
</tr>
<tr>
<td>DIVISION 03 – CONCRETE</td>
<td>03 3000 Cast-in-Place Concrete</td>
</tr>
<tr>
<td>DIVISION 04 – MASONRY</td>
<td>04 0513 Masonry Mortaring</td>
</tr>
<tr>
<td></td>
<td>04 7300 Simulated Stone</td>
</tr>
<tr>
<td>DIVISION 05 – METALS</td>
<td>05 1200 Structural Steel</td>
</tr>
<tr>
<td></td>
<td>05 3100 Steel Deck</td>
</tr>
<tr>
<td></td>
<td>05 4000 Cold-Formed Steel Framing</td>
</tr>
<tr>
<td></td>
<td>05 4500 Pre-Engineered Cold-Formed Steel Trussed Frames</td>
</tr>
<tr>
<td>DIVISION 06 - WOOD, PLASTICS AND COMPOSITES</td>
<td>06 1000 Rough Carpentry - Architectural</td>
</tr>
<tr>
<td></td>
<td>06 1000 Rough Carpentry - Structural</td>
</tr>
<tr>
<td></td>
<td>06 1360 Heavy Timber Trusses</td>
</tr>
<tr>
<td></td>
<td>06 1500 Wood Decking</td>
</tr>
<tr>
<td></td>
<td>06 1643 Gypsum Sheathing</td>
</tr>
<tr>
<td></td>
<td>06 4100 Architectural Wood Casework</td>
</tr>
<tr>
<td></td>
<td>06 6116 Solid Surfacing Fabrications</td>
</tr>
<tr>
<td>DIVISION 07 - THERMAL AND MOISTURE PROTECTION</td>
<td>07 2113 Board Insulation</td>
</tr>
<tr>
<td></td>
<td>07 2115 Batt Insulation</td>
</tr>
<tr>
<td></td>
<td>07 2616 Underslab Vapor Retarder</td>
</tr>
<tr>
<td></td>
<td>07 2800 Moisture Barriers</td>
</tr>
<tr>
<td></td>
<td>07 4113 Metal Roof Panels</td>
</tr>
<tr>
<td></td>
<td>07 4243 Composite Metal Wall Panels</td>
</tr>
<tr>
<td></td>
<td>07 6200 Sheet Metal Flashing &amp; Trim</td>
</tr>
<tr>
<td></td>
<td>07 6500 Flexible Flashing</td>
</tr>
<tr>
<td></td>
<td>07 8400 Firestopping</td>
</tr>
<tr>
<td></td>
<td>07 9200 Joint Sealers</td>
</tr>
</tbody>
</table>

Bidding Documents - October 31st 2018  TOC-1  Table of Contents
DIVISION 08 - OPENINGS

08 1100  Hollow Metal Frames & Doors
08 1416  Flush Wood Doors
08 3100  Access Doors & Panels
08 3616  Sliding Barn Doors
08 4113  Aluminum-Framed Entrances & Storefronts
08 4229  Automatic Entrances
08 7100  Door Hardware
08 8000  Glazing
08 9100  Louvers

DIVISION 09 - FINISHES

09 2900  Gypsum Board Assemblies
09 5100  Acoustical Ceilings
09 6500  Resilient Flooring & Base
09 6723  Resinous Flooring
09 6813  Tile Carpeting
09 9100  Paints & Coatings
09 9600  High-Performance Coatings

DIVISION 10 - SPECIALTIES

10 2813  Toilet Accessories
10 4413  Fire Extinguishers and Cabinets

DIVISION 11 - EQUIPMENT

11 3100  Residential Appliances

DIVISION 21 – FIRE PROTECTION

21 0510  General Fire Suppression Requirements
21 1100  Fire Suppression Piping
21 1300  Fire Suppression Sprinklers

DIVISION 22 – PLUMBING

22 0010  Plumbing General
22 0090  Plumbing Performance Verification
22 2500  Plumbing Insulation
22 4010  Plumbing Fixtures
22 4300  Drainage Systems
22 4400  Water Systems

DIVISION 23 – HEATING, VENTILATING AND AIR CONDITIONING

23 0513  Common Motor Requirements for HVAC Equipment
23 0553  Identification for HVAC Piping & Equipment
23 0593  Testing, Adjusting & Balancing for HVAC
23 0713  Duct Insulation
23 2300  Refrigerant Piping
23 3100  HVAC Ducts & Casings
23 3300  Air Duct Accessories
<p>| | | | | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>23 3423</td>
<td>HVAC Power Ventilators</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>23 3700</td>
<td>Air Outlets &amp; Inlets</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>23 7433</td>
<td>Dedicated Outdoor Air Units</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>23 8129</td>
<td>Variable Refrigerant Flow HVAC Systems</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**DIVISION 26 – ELECTRICAL**

<p>| | | | | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>26 0519</td>
<td>Low-Voltage Electrical Power Conductors &amp; Cables</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>26 0526</td>
<td>Grounding &amp; Bonding for Electrical Systems</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>26 0529</td>
<td>Hangers &amp; Supports for Electrical Systems</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>26 0533.13</td>
<td>Conduit for Electrical Systems</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>26 0533.16</td>
<td>Boxes for Electrical Systems</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>26 0533.23</td>
<td>Surface Raceways for Electrical Systems</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>26 0553</td>
<td>Identification for Electrical Systems</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>26 0583</td>
<td>Wiring Connections</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>26 0923</td>
<td>Lighting Control Devices</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>26 2100</td>
<td>Low-Voltage Electrical Service Entrance</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>26 2300</td>
<td>Low-Voltage Switchgear</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>26 2413</td>
<td>Switchboards</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>26 2416</td>
<td>Panelboards</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>26 2513</td>
<td>Low-Voltage Busways</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>26 2816.13</td>
<td>Enclosed Circuit Breakers</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>26 2816.16</td>
<td>Enclosed Switches</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>26 2913</td>
<td>Enclosed Controllers</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>26 4113</td>
<td>Lightning Protection for Structures</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>26 4300</td>
<td>Surge Protection Devices</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>26 5100</td>
<td>Interior Lighting</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>26 5600</td>
<td>Exterior Lighting</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**DIVISION 28 – ELECTRONIC SAFETY & SECURITY**

<p>| | | | | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>28 4600</td>
<td>Fire Detection &amp; Alarm</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

END OF TABLE OF CONTENTS
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. Description:
1. This Section includes the procedural requirements for quality assurance for Special Inspections.
2. Special inspection and testing services are required to provide a detailed verification of compliance with the Construction Documents, codes and standards specified. Special Inspection services and the presence of Special Inspectors on site do not relieve the Contractor of responsibility for compliance with the Construction Document requirements.
3. The Registered Design Professional for special inspections is typically the Architect or Structural Engineer. Often the Architect will take input from the Structural, Mechanical and Electrical Engineers and act as the overall Registered Design Professional in Responsible Charge of preparing and submitting the Statement of Special Inspections.

B. Related Documents and Standards:
1. All Special Inspections on this project shall conform to the Construction Documents and the applicable building code including referenced standards, in addition to this document. The Special Inspections Package has been submitted as part of the Construction Documents. These documents describe Contractor responsibilities, Fabricator responsibilities, required inspections/testing and inspections/testing frequency.
2. Hold a Special Inspections preconstruction meeting at least 7 days prior to initial planned date for start of work requiring Special Inspections.
   a. Discussions shall include the following:
      1) Review of specifications and Schedule of Special Inspections for work requiring Special Inspections.
      2) Responsibilities of Contractor, Owner, Testing Agency, Special Inspector, and Registered Design Professional:
   b. Notification and reporting procedures:
3. Attendees shall include Contractor, Owner’s Representative, Testing Agency, Special Inspector, and Registered Design Professionals for Structural Engineering and Architecture

C. Related Sections:
1. Division 03 Specifications – Concrete Construction.
2. Division 04 Specifications – Masonry Construction.
3. Division 05 Specifications – Steel Construction.
1.3 QUALITY CONTROL

A. Special Inspections shall be performed by agents who have relevant experience for each category of inspections. Minimum qualifications and certifications for each category are indicated in the building code.

B. Special Inspections and Testing: Owner will engage an agency to conduct Special Inspections and Testing as described in the referenced Special Inspections documentation and as required by authorities having jurisdiction.
   1. Special Inspector and his agents will notify Registered Design Professional and Contractor of deficiencies observed in the Work.
   2. Special Inspector and his agents will submit a certified written report of each test, inspection and similar quality-control service.
   3. Special Inspector and his agents will submit a Final Report of Special Inspections at the completion of the Special Inspections stating work was completed in substantial conformance with Construction Documents. Final Report of Special Inspections shall state required inspections have been performed and itemize nonconforming work not corrected or resolved as coordinated with the Design Professional in Responsible Charge. Final Report of Special Inspections is included with the Statements of Special Inspections for use by the Special Inspector(s) and his agents.
   4. Special Inspector and his agents will interpret tests and inspections and state in each report whether tested and inspected work complies with or deviates from the Construction Documents.
   5. Special Inspector and his agents will retest and reinspect corrected work.
   6. Owner’s selection of a Special Inspector in no way relieves the Contractor of responsibility to perform work in full compliance with Construction Documents.

C. Special Inspector and Agency Qualification Data: Inspection agencies shall submit a copy of their qualifications, including names and qualifications of each inspector and technician who will be performing inspections or tests, to the Code Enforcement Official. Special Inspector and Agency shall be acceptable to the Code Enforcement Official.

D. Reports: Special Inspectors shall submit inspection reports of each test or inspection to the Contractor, Architect of Record, Structural Engineer of Record, Design Professional in Responsible Charge, and the Owner. Reports to be submitted on forms approved by the Design Professional in Responsible Charge. All deficiencies shall be highlighted in reports and presence of deficiencies shall be noted within the report title.

E. Permits, Licenses, and Certificates: For Owner’s records, submit copies of certifications, inspection reports, releases, deficiencies, Architect/Engineer sketches regarding deficiencies, correspondence, records, and similar documents established for compliance with the Special Inspections program documented by the Special Inspection Statement and Schedule.

F. Owner shall provide all completed Special Inspection forms and schedule of Special Inspections to Special Inspector(s) with all Construction Documents and document changes.
PART 3 - EXECUTION

3.1 SPECIAL INSPECTION FORMS

A. Statements of Special Inspections: The attached Statements of Special Inspections, completed by the registered Design Professional in Responsible Charge, shall be submitted to the Building Official at the time of permit application. Copies of the forms, approved by the Building Official, shall be kept by the Contractor at a central location on the project site and submitted to the Design Professional in Responsible Charge.

B. Schedule of Special Inspections: The Schedule of Special Inspections shall be submitted to the Building Official at the time of permit application. Special Inspectors shall initial and date each item in the “Completed” column when the inspections for the specific scope of work are completed. A copy of the Schedule of Special Inspections containing signatures for all tasks requiring inspection shall be submitted to the Design Professional in Responsible Charge with the Final Reports of Special Inspections.

C. Contractor’s Statement of Responsibility: Contractor shall review the Statements of Special Inspections and Schedule of Special Inspections. Contractor shall complete the Contractor Statement of Responsibility and submit the statement to the Design Professional in Responsible Charge.

D. Fabricator’s Certificate of Compliance: Contractor shall forward one copy of Fabricator’s Certificate of Compliance to each Fabricator who provides fabrication materials noted for Special Inspection in the schedule and who is exempt from Special Inspection per Section 1704.2.5.2 of the Building Code. Contractor shall submit all Certificates to the Design Professional in Responsible Charge.

E. Final Report of Special Inspections: The Final Report of Special Inspections (blank report is submitted with the Statements of Special Inspections and Schedule, for reference) shall be submitted to the Building Official when all Special Inspection requirements for the project are completed and there are no outstanding deficiencies in work scheduled for inspections/testing. Each Special Inspection agency noted in the Schedule is required to submit a copy of this form for their scope of work.

3.2 OWNER RESPONSIBILITIES

A. Owner will engage and pay for services of Special Inspector and his agents.

B. Owner will engage either the Architect or one of his consultants to act as the Design Professional in Responsible Charge and pay for services of administrating this program.

C. The Design Professional will engage the services of the Special Inspector and his agents on behalf of GSFIC.

3.3 CONTRACTOR RESPONSIBILITIES

A. Contractor to whom building permit is issued shall have and maintain responsibility to manage, direct, and control construction activities on Project for which building permit is issued.
B. Contractor shall designate a representative who shall be the direct point-of-contact with the Special Inspector(s) during each phase of work. Designated representative will work with the Special Inspector(s) and Design Professional in Responsible Charge to communicate and coordinate for corrective actions required for discrepancies noted during work progress.

C. Contractor shall review the Schedule of Special Inspections to become familiar with all of the required testing and inspections and shall cooperate with Special inspector(s) to provide access to construction activities and manufacturer's operations that are to be tested/inspected.

D. Provide required copies of product test reports to Special Inspector(s).

E. Secure and deliver to Special Inspector(s) adequate quantities of representative material samples that require testing/inspection as part of the Schedule of Special Inspections.

F. Provide incidental labor and facilities:
   1. To facilitate tests and inspections that are required by Special Inspections and noted in the Schedule of Special Inspections.
   2. To provide access to construction activities to be tested.
   3. To obtain and handle samples at Project site or at source of product to be tested.
   4. For storage and curing of test samples.

G. Notify Special Inspector(s) and his agents at least 48 hours in advance of required inspection or test:
   1. When tests or inspections cannot be performed after such notice, immediately notify Special Inspector to discuss alterations of work and subsequent inspection(s) to allow for required testing/inspection by Special Inspector(s).
   2. If the Special Inspector is not notified in time to cancel and reschedule any required inspection, the Contractor shall reimburse Owner through Change Order procedure for Special Inspector(s) personnel and travel expenses incurred. Contractor, Special Inspector, and Owner shall develop procedures and associated costs for the Change Order procedure noted.

H. Contractor is responsible for retesting where results of inspections, tests, or other quality-control services prove unsatisfactory and indicate noncompliance with Construction Document requirements, regardless of whether original test was Contractor's responsibility.

I. Cost of construction related to retesting, deficiencies, corrective work, revised or replaced by Contractor, is Contractor's responsibility where required tests performed on original construction indicated noncompliance with Construction Document requirements.

J. Contractor shall be solely responsible for construction site safety.

3.4 SPECIAL INSPECTOR(S) RESPONSIBILITES

A. Review all Special Inspection statements and the Schedule of Special Inspections and become familiar with the structural design for the project and construction requirements, such that the Inspector(s) and his agents may provide adequate verification observations to assure conformance with Construction Documents.

B. Review Construction Documents and reference documents cited in sufficient detail that he may assure himself that conformance is provided.

C. Contact local Enforcement Agency/Building Official and Design Professional in Responsible Charge to determine requirements for testing/inspection report and nonconformance log
formatting and frequency. Determine if all reporting will be transmitted to the Design Professional in Responsible Charge or if any of the reporting must also be transmitted directly from the Special Inspector(s) to the local Enforcement Agency/Building Official.

D. Consult with the Design Professional in Responsible Charge for clarification regarding questions from the site, deficiencies, and misinterpretations of the work.

E. Attend preconstruction meetings and routine job conferences called by Contractor.

F. Provide on-site testing, inspections, and observations of phases of work in accordance with frequencies noted for each type of inspection in the Schedule of Special Inspections and to assure himself Contractor is performing work in accord with Construction Documents.

G. Receive and review required Contractor submittals for verification of conformance to Construction Documents.

H. Provide local Enforcement Agency/Building Official and Design Professional in Responsible Charge with periodic Special Inspection reports, all testing/inspection documentation, and reports of outstanding/resolved nonconformances with report formats and report frequencies coordinated at the start of the Special Inspections program.

3.5 LIMITS ON AUTHORITY

A. Special Inspector and his agents shall not release, revoke, alter, or enlarge on requirements of Construction Documents.

B. Special Inspector and his agents shall not have control over Contractor’s means and methods of construction.

C. Special Inspector and his agents shall not have authority to stop work.

3.6 COMMUNICATION

A. Testing Agency shall immediately notify Contractor and Registered Design Professional by e-mail of test results or inspections failing to comply with requirements of the Construction Documents.

B. Special Inspector shall immediately notify Contractor of work found to be in nonconformance with the Construction Documents. If nonconforming work is not corrected while the Special Inspector is on-site, Special Inspector shall notify Registered Design Professional within 24 hours (one business day) and issue a nonconformance report.

C. If nonconforming work is not corrected at time of substantial completion of structure or other appropriate time, Special Inspector shall notify Code Enforcement Official.

D. Special Inspector and his agents submit reports within 7 days of inspection or test.

E. Special Inspector and his agents shall leave report with the General Contractor and GSFIC prior to leaving the site each day. The final reviewed, typed report shall be submitted within 7 days of inspection or test.
3.7 REPAIR AND PROTECTION

A. General: Upon completion of inspection, testing, sample taking, and similar services, repair damaged construction and restore substrates and finishes to eliminate deficiencies, including deficiencies in visual qualities of exposed finishes.

B. Protect construction exposed by, or for, quality control service activities, and protect repaired construction.

C. Repair and protection is Contractor’s responsibility, regardless of assignment of responsibility for inspection, testing, or similar services.

END OF SECTION 01 4150
SECTION 02 8200
HAZARDOUS MATERIAL PROCEEDURES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Hazardous material abatement.

B. Related Sections:
   1. Division 01 - Administrative, procedural, and temporary work requirements.
   2. Division 02 - Demolition

1.2 IDENTIFIED HAZARDOUS MATERIALS

A. Prior to demolition the Contractor is responsible for the abatement of hazardous materials as identified in the following attached reports:

1.3 UNIDENTIFIED HAZARDOUS MATERIALS

A. During demolition operations, should suspect asbestos or asbestos-containing materials, or other material listed as a hazardous material by the Environmental Protection Agency be discovered, notify Owner and Design Professional and discontinue that portion of the work until further instructed.

PART 2 - PRODUCTS

Not used.

PART 3 - EXECUTION

Not used.

END OF SECTION
August 19, 2018

Lynn Planchon
Henry County, Board of Commissioners
SPLOST Management Division
112 S. Zack Hinton Parkway
McDonough, Ga. 30253

Subject: Report of Asbestos Survey to Support Planned Pre-remodel Demolition
Henry County Airport
474 Speedway Boulevard
Hampton, GA 30228
Henry County Project # SP4002
Anderson Project# 18-262

Ms. Planchon:

Anderson Environmental, Inc. (Anderson) is pleased to submit this report of the asbestos survey performed on the location known to be and/or located at 474 Speedway Boulevard, Hampton, GA 30228. The purpose of our services was to identify asbestos-containing materials (ACM) potentially impacted by the planned demolition and/or renovation efforts of the structure. This report presents our understanding of the project information, our survey findings, and our conclusions.

Anderson appreciates the opportunity to provide these services to you. Please contact us if you have any questions concerning this report, need additional information, and/or clarification.

Sincerely,

Anderson Environmental, Inc.

Jeffrey F. Davis
Asbestos Inspector
Email: andersonenv4@aol.com
Office: 770-707-1255
Fax: 678-228-2026
Mobile: 678-777-2495
PRE-REMODEL DEMOLITION
ASBESTOS SURVEY

474 Speedway Boulevard  Henry County Airport  August 19, 2018
Hampton, Ga  30228  Henry County Project# 4002  Anderson Project# 18-262
TABLE OF CONTENTS

1.0 BACKGROUND INFORMATION ................................................................. 1

2.0 SCOPE OF SERVICES .............................................................................. 1

3.0 ASBESTOS-CONTAINING MATERIALS SURVEY .................................... 1

   3.1 Visual Survey and Observations .......................................................... 1
   3.2 Sample Collection and Analysis ........................................................... 2
   3.3 Conclusions ......................................................................................... 3

ATTACHMENTS:

Asbestos Inspection Report Summary
EPD Notification
Photographic Documentation
Asbestos Sample Analysis Results
Chain of Custody
Laboratory Accreditation
Inspector Accreditation Certificate
1.0 BACKGROUND INFORMATION

It is our understanding that the structure located on the property known to be 474 Speedway Boulevard, Hampton, GA 30228 is to undergo a remodel requiring some components of the structure to be demolished.

The United States Environmental Protection Agency’s (EPA) National Emissions Standards for Hazardous air Pollutants (NESHAP) and Georgia Environmental Protection Division (EPD) Regulations require that ACM be appropriately addressed prior to any renovation or demolition activity. The United States Occupational Safety and Health Administration’s (OSHA) Occupational Exposure to Asbestos Standards, including the General Industry Standard [29 CFR 1910.1001] and Construction Industry Standard [29 CFR 1926.1101] require the determination of the presence, location, and quantity of ACM or presumed asbestos-containing materials (PACM) at the work site.

To support the pre-remodel demolition of the structure, Anderson, was retained to provide asbestos survey efforts to identify ACM potentially impacted by the planned demolition.

2.0 SCOPE OF SERVICES

The scope of our asbestos survey efforts included:

1. Visual survey of the interior and exterior of the structure and the identification of suspect asbestos-containing materials. Every effort has been made to identify the presence of ACM. A visual survey may not identify all ACM in the structure because its presence may not be known due to location, structure history and/or property information available to the inspector at time of survey. Additional suspect materials may be discovered during extensive renovation or demolition of the structure. Such suspect materials should be tested for asbestos content prior to removal.

2. Sample collection of suspect materials and laboratory analysis of the samples to determine the presence (or absence) of asbestos.


3.0 ASBESTOS- CONTAINING MATERIALS SURVEY

3.1 Visual Survey and Observations

Jeffrey Davis, an AHERA-accredited Asbestos in Building Inspector (Number 173004) performed the asbestos survey efforts on August 13, 2018. The visual survey consisted of a walk-through of the interior and the exterior. The structure, approximately 5,854 square feet (heated), appears to have been constructed in 1970, according to the Henry County tax records.
The structure is a metal frame, metal siding, commercial structure, consisting of one story on a concrete slab with a metal roof. The interior of the structure consisted of wood framed walls, wallboard/joint compound and acoustical tile with tile floor covering materials.

Overall condition of the structure appeared to be in “Good Condition” with no visible and/or notable signs of distress on the structure itself.

NOTATION –
1. No notable signs of distress.
2. See photos

The survey efforts included identification of suspect asbestos-containing materials as well as the quantification of those suspect materials in the stated areas. Suspect materials are those construction materials that have historically contained asbestos. A homogenous material area is one which contains suspect that seem by texture, color, and wear to be uniform, and that appear to have been applied and used during the same time period. Collectively, within the homogenous material areas, the following suspect materials were identified:

<table>
<thead>
<tr>
<th>Ceiling Material</th>
<th>Wall Material</th>
</tr>
</thead>
<tbody>
<tr>
<td>Flooring Material</td>
<td>Roof Material</td>
</tr>
</tbody>
</table>

3.2 SAMPLE COLLECTION AND ANALYSIS

Following the visual identification of suspect materials, a sampling strategy was developed to comply with regulatory protocols and sample locations were selected. Samples were collected from areas of readily accessible suspect materials. Because NESHAP requires a “thorough inspection” prior to demolition, our survey efforts included limited destructive sampling and sample locations were not repaired after collection.

Seventeen (17) samples of suspect materials were collected and delivered to EMSL Analytical, Inc. (2205 Corporate Plaza Parkway SE, Smyrna, GA 30080), a NVLAP accredited laboratory. The laboratory certificate is included as an attachment. Sample analysis was performed utilizing the EPA method of Polarized Light Microscopy (PLM) coupled with dispersion staining, “Method for the Determination of Asbestos in Bulk Building Materials” EPA/600/R-93/116. A PLM Report Summary is provided with this report that identifies materials sampled, describes corresponding sample locations, and analytical results.
3.3 **CONCLUSION**

Asbestos-containing materials were identified by Anderson’s survey efforts. All areas of the structure remained accessible during visual inspection.

In the following Attachment section, a summary asbestos inspection report describing asbestos containing materials and quantities of those asbestos-containing materials, bulk sample summary with analytical results, and photo log are included.

**CONFIRMED ASBESTOS CONTAINING MATERIALS**

A TOTAL OF SEVEN (17) SAMPLES OF SUSPECT ASBESTOS CONTAINING MATERIALS WERE COLLECTED FROM THIS LOCATION DURING THE SURVEY.

UPON ANALYSIS, THE FOLLOWING SAMPLES WERE FOUND TO CONTAIN ASBESTOS. MATERIALS CONTAINING <1% ASBESTOS ARE CONSIDERED/REFERRED TO AS ASBESTOS CONTAINING MATERIALS (ACM). FROM THESE RESULTS, IT IS OUR CONCLUSION THAT THE FOLLOWING MATERIALS WILL BE CONSIDERED ACM:

<table>
<thead>
<tr>
<th>Material</th>
<th>Asbestos Type</th>
<th>Quantity</th>
</tr>
</thead>
<tbody>
<tr>
<td>Black Mastic Throughout</td>
<td>4% Chrysotile</td>
<td>+/- 1,500 SqFt</td>
</tr>
<tr>
<td>Floor Tile Red- Elec/Rm</td>
<td>4% Chrysotile</td>
<td>+/- 10 SqFt</td>
</tr>
<tr>
<td>Floor Tile Black- Elec/Rm</td>
<td>4% Chrysotile</td>
<td>+/- 10 SqFt</td>
</tr>
<tr>
<td>RMC Black- Flashing</td>
<td>6% Chrysotile</td>
<td>+/- 200 SqFt</td>
</tr>
<tr>
<td>Mastic RMC Wht-Flash</td>
<td>6% Chrysotile</td>
<td>+/- 200 SqFt</td>
</tr>
</tbody>
</table>

**PRESUMED ASBESTOS CONTAINING MATERIAL**

CERTAIN TYPES OF MATERIAL SO COMMONLY CONTAIN ASBESTOS THAT BY LAW, WE ASSUME THEY CONTAIN ASBESTOS. THESE MATERIALS ARE CALLED “PRESUMED ASBESTOS-CONTAINING MATERIALS”, OR PACM FOR SHORT,

**NO PACM OBSERVED**
General Notes:

Survey Protocol – The asbestos survey and sample collection efforts utilized to identify and delineate the extent of asbestos-containing materials within the structure on these parcel(s) meet existing Environmental Protection Agency (EPA) NESHAPs regulatory requirements. The corresponding bulk sampling of suspect materials complies with current OSHA (AHERA/ASHARA) requirements for the identification of asbestos-containing materials in buildings, (i.e. referenced AHERA protocol). Materials historically known to have used asbestos in their manufacturing, such as, Transite panels, cement asbestos board and pipes, and black roof mastic were not samples and are assumed to contain asbestos.

Definition of ACM – Current NESHAPs regulations define asbestos-containing materials (ACM) as those materials containing ≥ 1 percent asbestos. NESHAPs notification and disposal requirements, enforced in the State of Georgia by the Georgia EPD, are “trigger” by materials containing ≥ 1 percent asbestos. Though existing OSHA regulations define ACM as those materials containing ≥ 1 percent asbestos, the regulations also apply to all materials identified to contain asbestos, no matter how minute the quantity, (i.e. ≤ 1 percent).

Wallboard and Joint Compound – Existing EPA regulations address wallboard and joint compound as a composite system, and allow composite sampling to determine the asbestos content of the combined wall system. However, OSHA does not allow composite sampling of wallboard and joint compound; rather, OSHA’s asbestos regulations require individual sampling of each wall system component. While existing NESHAPs regulatory requirements for notifications and disposal do not apply for composite wallboard systems containing < 1 percent asbestos, OSHA’s Asbestos Construction Industry Standard (49CFR1926.1101) does apply. OSHA’s regulatory requirements include but are not limited to worker training; engineering controls and work practices, communication of hazards, and waste disposal do apply to wallboard systems with any identified asbestos content.
EXISTING CONDITIONS

(NOTE – To protect privacy – personal contents are generally not photographed)
Please refer to the attached drawings and/or pictures for specific location and visual of ACM

Beacon & Tower

Electrical Mechanical Room
Front Porch

Hallway to Kitchen
Office Roof

Radar Control Room
We thank you for this opportunity to work with you on this project. If you have any questions or need additional information please feel free to contact our office.

Sincerely,

Jeffrey F. Davis

Jeffrey F. Davis
Certificate 173004
Expiration 10/17/2017

Mobile - 678-777-2495
Office - 770-707-1255
Email - andersonenv4@aol.com
## Test Report: Asbestos Analysis of Bulk Materials via EPA 600/R-93/116 Method using Polarized Light Microscopy

<table>
<thead>
<tr>
<th>Sample</th>
<th>Description</th>
<th>Appearance</th>
<th>% Fibrous</th>
<th>% Non-Fibrous</th>
<th>Asbestos % Type</th>
</tr>
</thead>
<tbody>
<tr>
<td>1-Floor Tile</td>
<td>FT Wht 12x12 - Restroom</td>
<td>White - Non-Fibrous, Homogeneous</td>
<td>100%</td>
<td>0%</td>
<td>None Detected</td>
</tr>
<tr>
<td>071805381-0001</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1-Mastic</td>
<td>FT Wht 12x12 - Restroom</td>
<td>Yellow - Non-Fibrous, Homogeneous</td>
<td>100%</td>
<td>0%</td>
<td>None Detected</td>
</tr>
<tr>
<td>071805381-0001A</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2-Floor Tile</td>
<td>FT Wht 12x12 - Hall</td>
<td>White - Non-Fibrous, Homogeneous</td>
<td>100%</td>
<td>0%</td>
<td>None Detected</td>
</tr>
<tr>
<td>071805381-0002</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2-Mastic</td>
<td>FT Wht 12x12 - Hall</td>
<td>Black - Non-Fibrous, Homogeneous</td>
<td>96%</td>
<td>4%</td>
<td>Chrysotile</td>
</tr>
<tr>
<td>071805381-0002A</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3-Floor Tile</td>
<td>FT Brm 12x12 - Office Hall, Kitchen</td>
<td>Brown - Non-Fibrous, Homogeneous</td>
<td>100%</td>
<td>0%</td>
<td>None Detected</td>
</tr>
<tr>
<td>071805381-0003</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3-Mastic</td>
<td>FT Brm 12x12 - Office Hall, Kitchen</td>
<td>Brown - Non-Fibrous, Homogeneous</td>
<td>100%</td>
<td>0%</td>
<td>None Detected</td>
</tr>
<tr>
<td>071805381-0003A</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>4-Floor Tile</td>
<td>FT Brm 12x12 - Office Hall, Kitchen</td>
<td>Brown - Non-Fibrous, Homogeneous</td>
<td>100%</td>
<td>0%</td>
<td>None Detected</td>
</tr>
<tr>
<td>071805381-0004</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>4-Mastic</td>
<td>FT Brm 12x12 - Office Hall, Kitchen</td>
<td>Brown - Non-Fibrous, Homogeneous</td>
<td>100%</td>
<td>0%</td>
<td>None Detected</td>
</tr>
<tr>
<td>071805381-0004A</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>5-Joint Compound</td>
<td>WBJC - Meeting Rm</td>
<td>White - Non-Fibrous, Homogeneous</td>
<td>100%</td>
<td>0%</td>
<td>None Detected</td>
</tr>
<tr>
<td>071805381-0005</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>5-Drywall</td>
<td>WBJC - Meeting Rm</td>
<td>Gray - Non-Fibrous, Homogeneous</td>
<td>100%</td>
<td>0%</td>
<td>None Detected</td>
</tr>
<tr>
<td>071805381-0005A</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>6-Joint Compound</td>
<td>WBJC - Office</td>
<td>White - Non-Fibrous, Homogeneous</td>
<td>100%</td>
<td>0%</td>
<td>None Detected</td>
</tr>
<tr>
<td>071805381-0006</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>6-Drywall</td>
<td>WBJC - Office</td>
<td>Gray - Non-Fibrous, Homogeneous</td>
<td>100%</td>
<td>0%</td>
<td>None Detected</td>
</tr>
<tr>
<td>071805381-0006A</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>7</td>
<td>CT - Office</td>
<td>Gray - Fibrous, Homogeneous</td>
<td>60%</td>
<td>30%</td>
<td>Non-Fibrous</td>
</tr>
<tr>
<td>071805381-0007</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>8</td>
<td>CT - Kit</td>
<td>Gray - Fibrous, Homogeneous</td>
<td>60%</td>
<td>30%</td>
<td>Non-Fibrous</td>
</tr>
<tr>
<td>071805381-0008</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>9-Joint Compound</td>
<td>WBJC - Storage Rm</td>
<td>White - Non-Fibrous, Homogeneous</td>
<td>100%</td>
<td>0%</td>
<td>None Detected</td>
</tr>
<tr>
<td>071805381-0009</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Initial report from: 08/13/2018 10:56:37
## Test Report: Asbestos Analysis of Bulk Materials via EPA 600/R-93/116 Method using Polarized Light Microscopy

<table>
<thead>
<tr>
<th>Sample</th>
<th>Description</th>
<th>Appearance</th>
<th>% Fibrous</th>
<th>Asbestos Type</th>
<th>% Type</th>
</tr>
</thead>
<tbody>
<tr>
<td>9-Drywall</td>
<td>WBJC - Storage Rm</td>
<td>Gray Non-Fibrous Homogeneous</td>
<td>100%</td>
<td>Non-fibrous (Other)</td>
<td>None Detected</td>
</tr>
<tr>
<td>10-Joint Compound</td>
<td>WBJC - Radar Control</td>
<td>White Non-Fibrous Homogeneous</td>
<td>100%</td>
<td>Non-fibrous (Other)</td>
<td>None Detected</td>
</tr>
<tr>
<td>10-Drywall</td>
<td>WBJC - Radar Control</td>
<td>Gray Non-Fibrous Homogeneous</td>
<td>100%</td>
<td>Non-fibrous (Other)</td>
<td>None Detected</td>
</tr>
<tr>
<td>11-Floor Tile</td>
<td>FT Red - Elec/Rm</td>
<td>Red Non-Fibrous Homogeneous</td>
<td>96%</td>
<td>Non-fibrous (Other)</td>
<td>4% Chrysotile</td>
</tr>
<tr>
<td>11-Mastic</td>
<td>FT Red - Elec/Rm</td>
<td>Black Non-Fibrous Homogeneous</td>
<td>95%</td>
<td>Non-fibrous (Other)</td>
<td>5% Chrysotile</td>
</tr>
<tr>
<td>12-Floor Tile</td>
<td>FT Blk - Elec/Rm</td>
<td>Black Non-Fibrous Homogeneous</td>
<td>96%</td>
<td>Non-fibrous (Other)</td>
<td>4% Chrysotile</td>
</tr>
<tr>
<td>12-Mastic</td>
<td>FT Blk - Elec/Rm</td>
<td>Brown Non-Fibrous Homogeneous</td>
<td>100%</td>
<td>Non-fibrous (Other)</td>
<td>None Detected</td>
</tr>
<tr>
<td>13</td>
<td>RMC Wht - Field</td>
<td>White Non-Fibrous Homogeneous</td>
<td>100%</td>
<td>Non-fibrous (Other)</td>
<td>None Detected</td>
</tr>
<tr>
<td>14</td>
<td>RMC Blk - Flash</td>
<td>Black Non-Fibrous Homogeneous</td>
<td>94%</td>
<td>Non-fibrous (Other)</td>
<td>6% Chrysotile</td>
</tr>
<tr>
<td>15-Flashing</td>
<td>RMC Wht - Flash</td>
<td>White Non-Fibrous Homogeneous</td>
<td>20% Synthetic</td>
<td>80% Non-fibrous (Other)</td>
<td>None Detected</td>
</tr>
<tr>
<td>15-Mastic</td>
<td>RMC Wht - Flash</td>
<td>Black Non-Fibrous Homogeneous</td>
<td>94%</td>
<td>Non-fibrous (Other)</td>
<td>6% Chrysotile</td>
</tr>
<tr>
<td>16</td>
<td>RSC</td>
<td>Silver Non-Fibrous Homogeneous</td>
<td>100%</td>
<td>Non-fibrous (Other)</td>
<td>None Detected</td>
</tr>
<tr>
<td>17</td>
<td>RSC</td>
<td>Silver Non-Fibrous Homogeneous</td>
<td>100%</td>
<td>Non-fibrous (Other)</td>
<td>None Detected</td>
</tr>
</tbody>
</table>

Analyst(s)

Kyle Rich (25)
Violedah Richardson (4)

Amber Baynes, Asbestos Lab Supervisor or Other Approved Signatory
Company: Anderson Environmental, Inc.
Street: 514 Speedway Blvd.
Project Name/Number:
City: Hampton
Report To (Name): Tim Anderson
Telephone #: Office-770.707.1255 / Cell-404 723-7405
Email Address: Tim@AndersonEnvironmentalinc.com

Please Provide Results:
TEM
PCM - Air
PLM - Bulk
TEM

All Fiber Sizes

TEM
All Fiber Sizes
Wipe and Bulk Samples
Air Samples

❑ NIOSH 7400
❑ AHERA 40 CFR, Part 763
❑ NIOSH 7402
❑ EPA Level II
❑ ISO 10312

TEM - Water

Fibers >10µm
❑ NIOSH 1981 (friable-NC)
❑ NIOSH 1988 (non-friable-NC)
Point Count: 400 (<0.25%) 1000 (<0.1%)
Point Count w/Granimetric: 400 (<0.25%) 1000 (<0.1%)

Lead (Pb)

PM - Air
PLM - Bulk

TEM - Dust

Asbestos

Materials Science

Porous Atomic Absorption

Materials Science

Wipe and Bulk Samples

Microbial - ASTM D 5755

Microbiology

Other:

Water Samples

Lead (Pb)

Other

Other:

Other:

Other:

Other:

X-Ray Fluorescence (elem. analysis)

Common Particle ID (large particles)

Combustion-by-products (soot, char, etc.)

Other:

Other:

Other:

Other:

Other:

Other:

Other:

Other:

Other:

Other:

Other:

Other:

Other:

Other:

Other:

Other:

Other:

Other:

Other:

Other:

Other:

Other:

Other:

Other:

Other:

Other:

Other:

Other:

Other:

Other:

Other:

Other:

Other:

Other:

Other:

Other:

Other:

Other:

Other:

Other:

Other:

Other:

Other:

Other:

Other:

Other:

Other:

Other:

Other:

Other:

Other:

Other:

Other:

Other:

Other:

Other:

Other:

Other:

Other:

Other:

Other:

Other:

Other:

Other:

Other:

Other:

Other:

Other:

Other:

Other:

Other:

Other:

Other:

Other:

Other:

Other:

Other:

Other:

Other:

Other:

Other:

Other:

Other:

Other:

Other:

Other:

Other:

Other:

Other:

Other:

Other:

Other:

Other:

Other:

Other:

Other:

Other:

Other:

Other:

Other:

Other:

Other:

Other:

Other:

Other:

Other:

Other:

Other:

Other:

Other:

Other:

Other:

Other:

Other:

Other:

Other:

Other:

Other:

Other:

Other:

Other:

Other:

Other:

Other:

Other:

Other:

Other:

Other:

Other:

Other:

Other:

Other:

Other:

Other:

Other:

Other:

Other:

Other:

Other:

Other:

Other:

Other:

Other:

Other:

Other:

Other:

Other:

Other:

Other:

Other:

Other:

Other:

Other:

Other:

Other:

Other:

Other:

Other:

Other:

Other:

Other:

Other:

Other:

Other:

Other:

Other:

Other:

Other:

Other:

Other:

Other:

Other:

Other:

Other:

Other:

Other:

Other:

Other:

Other:

Other:

Other:

Other:

Other:

Other:

Other:

Other:

Other:

Other:

Other:

Other:

Other:

Other:

Other:

Other:

Other:

Other:

Other:

Other:

Other:

Other:

Other:

Other:

Other:

Other:

Other:

Other:

Other:

Other:

Other:

Other:

Other:

Other:

Other:

Other:

Other:

Other:

Other:

Other:

Other:

Other:

Other:

Other:

Other:

Other:

Other:

Other:

Other:

Other:

Other:

Other:

Other:

Other:

Other:

Other:

Other:

Other:

Other:

Other:

Other:

Other:

Other:

Other:

Other:

Other:

Other:

Other:

Other:

Other:

Other:

Other:

Other:

Other:

Other:

Other:

Other:

Other:

Other:

Other:

Other:

Other:

Other:

Other:

Other:

Other:

Other:

Other:

Other:

Other:

Other:

Other:

Other:

Other:

Other:

Other:

Other:

Other:

Other:

Other:

Other:

Other:

Other:

Other:

Other:

Other:

Other:

Other:

Other:

Other:

Other:

Other:

Other:

Other:

Other:

Other:

Other:

Other:

Other:

Other:

Other:

Other:

Other:

Other:

Other:

Other:

Other:

Other:

Other:

Other:

Other:

Other:

Other:

Other:

Other:

Other:

Other:

Other:

Other:

Other:

Other:

Other:

Other:

Other:

Other:

Other:

Other:

Other:

Other:

Other:

Other:

Other:

Other:

Other:

Other:

Other:

Other:

Other:

Other:

Other:

Other:

Other:

Other:

Other:

Other:

Other:

Other:

Other:

Other:

Other:

Other:

Other:

Other:

Other:

Other:

Other:

Other:

Other:

Other:

Other:

Other:

Other:

Other:

Other:

Other:

Other:

Other:

Other:

Other:

Other:

Other:

Other:

Other:

Other:

Other:

Other:

Other:

Other:

Other:

Other:

Other:

Other:

Other:

Other:

Other:

Other:

Other:

Other:

Other:

Other:

Other:

Other:

Other:

Other:

Other:

Other:

Other:

Other:

Other:

Other:

Other:

Other:

Other:

Other:

Other:

Other:

Other:

Other:

Other:

Other:

Other:

Other:

Other:

Other:

Other:

Other:

Other:

Other:

Other:

Other:

Other:

Other:

Other:

Other:

Other:

Other:

Other:

Other:

Other:

Other:

Other:

Other:

Other:

Other:

Other:

Other:

Other:

Other:

Other:

Other:

Other:

Other:

Other:

Other:

Other:

Other:

Other:

Other:

Other:

Other:

Other:

Other:

Other:
<table>
<thead>
<tr>
<th>Sample #</th>
<th>Sample Description</th>
<th>Volume/Area (Air) HA # (Bulk)</th>
<th>Date/Time Sampled</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>FT Whit 12x12 Restroom</td>
<td>3.000</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>&quot;</td>
<td></td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>FT Bvn 12x12 Office Hall, Kitchen</td>
<td>1.000</td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>&quot;</td>
<td></td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>WBJC Meeting Rm</td>
<td>3.000</td>
<td></td>
</tr>
<tr>
<td>6</td>
<td>&quot;</td>
<td></td>
<td></td>
</tr>
<tr>
<td>7</td>
<td>CT Office</td>
<td>1.200</td>
<td></td>
</tr>
<tr>
<td>8</td>
<td>&quot;</td>
<td></td>
<td></td>
</tr>
<tr>
<td>9</td>
<td>WBJC Storage Rm</td>
<td>6.000</td>
<td></td>
</tr>
<tr>
<td>10</td>
<td>&quot;</td>
<td></td>
<td></td>
</tr>
<tr>
<td>11</td>
<td>FT Red Elec Rm</td>
<td>1.00</td>
<td></td>
</tr>
<tr>
<td>12</td>
<td>FT Blk</td>
<td>1.00</td>
<td></td>
</tr>
<tr>
<td>13</td>
<td>RMC Whit Field</td>
<td>2.000</td>
<td></td>
</tr>
<tr>
<td>14</td>
<td>RMC Blk Flash</td>
<td>2.00</td>
<td></td>
</tr>
<tr>
<td>15</td>
<td>RMC Whit Flash</td>
<td>2.00</td>
<td></td>
</tr>
<tr>
<td>16</td>
<td>RSC</td>
<td>6.000</td>
<td></td>
</tr>
<tr>
<td>17</td>
<td>RSC</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

*Comments/Special Instructions:

Analysis Completed in Accordance with EMSL's Terms and Conditions located in the Analytical Price Guide*
United States Department of Commerce  
National Institute of Standards and Technology

NVLAP®

Certificate of Accreditation to ISO/IEC 17025:2005

NVLAP LAB CODE: 101048-1

EMSL Analytical, Inc.  
Smyrna, GA

is accredited by the National Voluntary Laboratory Accreditation Program for specific services,  
listed on the Scope of Accreditation, for:

Asbestos Fiber Analysis

This laboratory is accredited in accordance with the recognized International Standard ISO/IEC 17025:2005.  
This accreditation demonstrates technical competence for a defined scope and the operation of a laboratory quality  
management system (refer to joint ISO-ILAC-IAF Communiqué dated January 2009).

2018-07-01 through 2019-06-30  
Effective Dates

For the National Voluntary Laboratory Accreditation Program
SCOPE OF ACCREDITATION TO ISO/IEC 17025:2005

EMSL Analytical, Inc.
2205 Corporate Plaza Parkway SE
Suite 200
Smyrna, GA 30080
Ms. Amber Baynes
Phone: 770-956-9150  Fax: 770-956-9181
Email: abaynes@emsl.com
http://www.emsl.com

ASBESTOS FIBER ANALYSIS

Bulk Asbestos Analysis

<table>
<thead>
<tr>
<th>Code</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>18/A01</td>
<td>EPA — 40 CFR Appendix E to Subpart E of Part 763, Interim Method of the Determination of Asbestos in Bulk Insulation Samples</td>
</tr>
<tr>
<td>18/A03</td>
<td>EPA 600/R-93/116: Method for the Determination of Asbestos in Bulk Building Materials</td>
</tr>
</tbody>
</table>

Airborne Asbestos Analysis

<table>
<thead>
<tr>
<th>Code</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>18/A02</td>
<td>U.S. EPA's &quot;Interim Transmission Electron Microscopy Analytical Methods—Mandatory and Nonmandatory—and Mandatory Section to Determine Completion of Response Actions&quot; as found in 40 CFR, Part 763, Subpart E, Appendix A.</td>
</tr>
</tbody>
</table>

Effective 2018-07-01 through 2019-06-30
Certificate of Achievement

This certificate is awarded to:

JEFFREY F DAVIS

In recognition of satisfactory completion of the EPA-approved annual asbestos refresher training course under section 206 of the Toxic Substance Control Act (TSCA), Title II entitled:

BUILDING INSPECTOR

COURSE COMPLETION DATE: AUGUST 13, 2018
EXAMINATION DATE: AUGUST 13, 2018
EXPIRATION DATE: AUGUST 13, 2019
COURSE HOURS: 4.0

Danaya N. Benedetto
CEO & Training Program Manager
Credential License ID: 11832772

Michael A. Benedetto
Instructor
CHC Training Certificate No. R18-1592-Al-O-GA

www.chctraining.com
303.412.6360
855.60.CERTIFY

1775 West 55th Avenue
Denver, CO 80221,
United States of America
Report of Lead Survey to Support Planned Re-Remodel Demolition

August 20, 2018

Property Address: Henry County Airport
474 Speedway Boulevard
Hampton, GA 30228
Henry County Project # SP4002

Requested By: Lynn Planchon
Henry County, Board of Commissioners
SPLOST Management Division
112 S. Zack Hinton Parkway
McDonough, Ga. 30253

Inspector: Vickie Davis
Anderson Environmental, Inc.
514 Speedway Blvd.
Hampton, GA 30228
PO Box 1264
Hampton, GA 30228

Anderson Environmental Job No.:
18-262
Background:

Lead-related regulations come from three main bodies, The US Department of Housing and Urban Development (HUD), The US Environmental Protection Agency, and The US Department of Labor's Occupational Safety and Health Administration (OSHA). HUD and EPA define lead-based paint as “paint or other surface coatings that contain lead equal to or exceeding 1.0 milligram per square centimeter or 0.5 percent by weight or 5,000 parts per million (ppm) by weight.”

HUD sets standards for evaluation and management of lead in federally-assisted housing, and promotes efforts to reduce lead hazards in privately owned housing. As such, HUD issued “The Guidelines for the Evaluation and Control of Lead-Based Paint Hazards in Housing”. The Guidelines were issued pursuant to Section 1017 of the Residential Lead-Based Paint Hazard Reduction Act of 1992, often referred to as Title X.

EPA regulates ecological and environmental conditions, and their primary focus with regard to lead-based paint relates to proper disposal. EPA regulations require that waste generated from demolition, renovation, or abatement be subjected to a laboratory analysis referred to as a Toxicity Characteristic Leaching Procedure (TCLP). The purpose of this test is to determine whether the solid waste exhibits a toxicity characteristic sufficient enough for the waste to be classified as “hazardous waste”. Solid waste exhibiting a toxicity characteristic of greater than or equal to 5.0 mg/L must be characterized as “hazardous waste” and disposed of accordingly. Solid waste exhibiting a toxicity characteristic of less than 5.0 mg/L would not be considered “hazardous waste”, and may be disposed in a Municipal Solid Waste Landfill.

OSHA’s concerns are different from those of HUD and EPA. OSHA’s mission is to assure the safety and health of America’s workers. With regard to lead-based paint, OSHA relies primarily on airborne measurements to assess employee exposure. OSHA regulation 29 CFR 1926.62 requires employers to provide adequate protection to their workers that may be exposed to lead dust in excess of the action level of 30 micrograms per cubic meter of air. Where lead is present at any level of concentration, the Federal regulation requires employers to perform exposure assessment air monitoring during any demolition or renovation activity that might create lead dust. If no employee is exposed to the action level during this initial assessment, further monitoring can be suspended.
August 13, 2018; Anderson Environmental, Inc. conducted a Limited Lead Survey, for the purpose of identifying potential Lead Based Paint(s) were present prior to proposed renovation of the Henry County Airport. Samples were taken representing 4 potential lead-paint hazard sites – White and Red Beacon. Five (5) samples of potential lead-paint hazard paint chips were collected and analyzed, each sample returned a positive indication for lead based paint content. Samples were analyzed by EMSL Analytical Laboratories. See summary below, and report attached.

As seen in the analytical report from EMSL, all samples contain a percentage of lead. With the exception of locations P3 through P5, all locations exceed the 0.5% by weight threshold set forth in the previous section. Proper care should be taken to limit exposure, following required OSHA and EPA guidelines.

In addition, should these areas be left undisturbed during the planned renovation contractors, employees, etc. should be advised of the potential lead hazards working within these area(s)

<table>
<thead>
<tr>
<th>Client Sample Description</th>
<th>Lab ID</th>
<th>Collected</th>
<th>Analyzed</th>
<th>Weight</th>
<th>Lead Concentration</th>
</tr>
</thead>
<tbody>
<tr>
<td>P1</td>
<td>02180569-0001</td>
<td>8/10/2018</td>
<td>8/14/2018</td>
<td>0.0837 g</td>
<td>2.9 % wt</td>
</tr>
<tr>
<td>Site: Red Beacon</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>P2</td>
<td>02180569-0002</td>
<td>8/10/2018</td>
<td>8/14/2018</td>
<td>0.2153 g</td>
<td>1.2 % wt</td>
</tr>
<tr>
<td>Site: Wht Beacon</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>P3</td>
<td>02180569-0003</td>
<td>8/10/2018</td>
<td>8/14/2018</td>
<td>0.3057 g</td>
<td>0.025 % wt</td>
</tr>
<tr>
<td>Site: Red Tower</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>P4</td>
<td>02180569-0004</td>
<td>8/10/2018</td>
<td>8/14/2018</td>
<td>0.2606 g</td>
<td>0.038 % wt</td>
</tr>
<tr>
<td>Site: Wht Tower</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>P5</td>
<td>02180569-0005</td>
<td>8/10/2018</td>
<td>8/14/2018</td>
<td>0.297 g</td>
<td>0.0080 % wt</td>
</tr>
<tr>
<td>Site: Wht Office Porch</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**CONFIRMED LEAD-BASED PAINT**

- Red Beacon
- White Beacon
- Red Tower
- White Tower
- White Office Porch
We thank you for this opportunity to work with you on this project. If you have any questions or need additional information please feel free to contact our office.

If you should have any questions, please contact our office.

Sincerely,

Vickie Davis
Andersonenv4@aol.com
404-723-7411
# Test Report: Lead in Paint Chips by Flame AAS (SW 846 3050B/7000B)*

<table>
<thead>
<tr>
<th>Client Sample Description</th>
<th>Lab ID</th>
<th>Collected</th>
<th>Analyzed</th>
<th>Weight</th>
<th>Lead Concentration</th>
</tr>
</thead>
<tbody>
<tr>
<td>P1</td>
<td>021805689-0001</td>
<td>8/10/2018</td>
<td>8/14/2018</td>
<td>.0837 g</td>
<td>2.9 % wt</td>
</tr>
<tr>
<td>Site: Red Beacon</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>P2</td>
<td>021805689-0002</td>
<td>8/10/2018</td>
<td>8/14/2018</td>
<td>.2153 g</td>
<td>1.2 % wt</td>
</tr>
<tr>
<td>Site: Wht Beacon</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>P3</td>
<td>021805689-0003</td>
<td>8/10/2018</td>
<td>8/14/2018</td>
<td>.3057 g</td>
<td>0.025 % wt</td>
</tr>
<tr>
<td>Site: Red Tower</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>P4</td>
<td>021805689-0004</td>
<td>8/10/2018</td>
<td>8/14/2018</td>
<td>.2606 g</td>
<td>0.039 % wt</td>
</tr>
<tr>
<td>Site: Wht Tower</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>P5</td>
<td>021805689-0005</td>
<td>8/10/2018</td>
<td>8/14/2018</td>
<td>.297 g</td>
<td>0.0080 % wt</td>
</tr>
<tr>
<td>Site: Wht Office Porch</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

*Analysis following Lead in Paint by EMSL SOP/Determination of Environmental Lead by FLAA. Reporting limit is 0.010 % wt based on the minimum sample weight per our SOP. Unless noted, results in this report are not blank corrected. This report relates only to the samples reported above and may not be reproduced, except in full, without written approval by EMSL. EMSL bears no responsibility for sample collection activities. Samples received in good condition unless otherwise noted. “<” (less than) result signifies that the analyte was not detected at or above the reporting limit. Measurement of uncertainty is available upon request. The QC data associated with the sample results included in this report meet the recovery and precision requirements unless specifically indicated otherwise. Definitions of modifications are available upon request.

Samples analyzed by EMSL Analytical, Inc. Kernersville, NC EMSL Lab ID 102564 is accredited by the AIHA Laboratory Accreditation Program (AIHA-LAP), LLC in the Environmental Lead accreditation program for Lead in Paint Chips.

Initial report from 08/14/2018 15:28:53

James Cole, Laboratory Manager or other approved signatory
**Chain of Custody**

**EMSL Order Number (Lab Use Only):**

**OrderID:** 021805689

**Company:** Anderson Environmental, Inc.

**Street:** 514 Speedway Blvd

**City:** Hampton

**State/Province:** GA

**Zip/Postal Code:** 30228

**Country:** USA

**Report To (Name):** Tim Anderson

**Telephone #:** Office-770.707.1255 / Cell-404-73-23-7405

**Email Address:** Tim@AndersonEnvironmentalInc.com

**Project Name/Number:** 18.262 Henry County Airport ACM Inspection

**Please Provide Results:** ☐ Fax ☑ Email

**U.S. State Samples Taken:**

<table>
<thead>
<tr>
<th>Turnaround Time (TAT) Options* - Please Check</th>
</tr>
</thead>
<tbody>
<tr>
<td>☐ 3 Hour ☐ 6 Hour ☑ 24 Hour ☐ 48 Hour ☐ 72 Hour ☐ 96 Hour ☐ 1 Week ☐ 2 Week</td>
</tr>
</tbody>
</table>

*For RUSH TAT's Please Call Ahead to Confirm Lab Hours and Availability. Not all TAT options are valid for every test. Materials Science and IAQ TATs are in Business Days rather than Hours (i.e. 24 Hour = End of Next Business Day)

### Asbestos

- **PCM - Air**
  - NIOSH 7400
  - w/ 8hr. TWA

- **TEM - Air**
  - 4.4hr TAT (AHRA ONLY)
  - AHERA 40 CFR, Part 763
  - NIOSH 7402
  - EPA Level II
  - ISO 10312

- **TEM - Water**
  - Fibers >10μm
  - Waste
  - Drinking
  - All Fiber Sizes
  - Waste
  - Drinking

- **PLM - Bulk**
  - PLM EPA 600/R-93/116
  - PLM EPA NOB (<1%)
  - NYS 198.1 (non-friable-NY)
  - NYS 198.6 (non-friable-NY)
  - Point Count: 400 (<0.25%) 1000 (<0.1%)
  - Point Count w/ Gravimetric: 400 (<0.25%) 1000 (<0.1%)

- **TEM - Dust**
  - Microvac – ASTM D 5755
  - Wipe-ASTM D6480

### Flame Atomic Absorption

- **Flame Atomic Absorption**
  - X Chips SW846-7000B or AOAC 974.02
  - Soil SW846-7000B/7420
  - Air NIOSH 7082
  - Wastewater SM3111B or SW846-7000B/7420
  - ASTM Wipe SW846-7000B/7420
  - non ASTM Wipe SW846-7000B/7420
  - TCLP SW846-1311/7420/SN 3111B

### Lead (Pb)

- **Lead (Pb)**
  - Soil SW846-7421
  - Air NIOSH 7105
  - Drinking Water EPA 200.9

### Microbiology

- **Microbiology**
  - Wipe & Bulk Samples
    - Mold & Fungi – Direct Examination
    - Mold & Fungi Culture (Genus Only)
    - Mold & Fungi Culture (Genus & Species)
    - Bacterial Count & ID (Up to Three Types)
    - Bacterial Count & ID (Up to Five Types)
    - MRSA
    - Pseudomonas aeruginosa

### Water Samples

- **Water Samples**
  - Total Coliform & E.coli (P/A)
  - Fecal Coliform (SM 9222D)
  - Sewage Screen
  - Heterotrophic Plate Count (SM 9215)

### Comments/Special Instructions:

- **Client Sample #’s**
- **Total # of Samples:**
- **Analysis Completed in Accordance with EMSL’s Terms and Conditions located in the Analytical Price Guide**

**Contact Information**

EMSL Analytical, Inc.
200 Route 130 North
Cinnaminson, NJ 08077
Phone: (800) 220-3675
Fax: (856) 786-5974
<table>
<thead>
<tr>
<th>Sample #</th>
<th>Sample Description</th>
<th>Volume/Area (Air)</th>
<th>Date/Time Sampled</th>
</tr>
</thead>
<tbody>
<tr>
<td>P1</td>
<td>Red Beacon</td>
<td></td>
<td></td>
</tr>
<tr>
<td>P2</td>
<td>wht 11</td>
<td></td>
<td></td>
</tr>
<tr>
<td>P3</td>
<td>Red Tower</td>
<td></td>
<td></td>
</tr>
<tr>
<td>P4</td>
<td>wht 11</td>
<td></td>
<td></td>
</tr>
<tr>
<td>P5</td>
<td>wht office Porch</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

*Comments/Special Instructions:

Analysis Completed in Accordance with EMSL’s Terms and Conditions located in the Analytical Price Guide.
SECTION 03 3000
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. Description:
   1. This section includes cast-in-place concrete, including formwork, reinforcement, concrete materials, mixture design, placement procedures, and finishes, for the following:
      a. Footings.
      b. Slabs-On-Grade.

B. Related Documents and Standards:
   1. All referenced standards and cited publications shall be those specifically denoted within the applicable building code noted in the General Notes of the Construction Drawings.
   2. All cast-in-place concrete work on this project shall conform to the Construction Documents, applicable building code including referenced standards, the requirements of "Specification for Structural Concrete" ACI 301-16 (Chapters 1-5, & Chapters 6-14 as applicable) and "Specifications for Tolerances for Concrete Construction and Materials" ACI 117, in coordination with clarifications, exemptions, and additions in the Construction Documents.

C. Related Sections:
   1. Division 03 Specifications – Concrete Construction.
   2. Division 07 Specifications – Thermal and Moisture Protection.
   3. Division 31 Specifications – Earthwork.

1.3 QUALITY ASSURANCE

A. Mockups: Cast concrete slab-on-grade panels to demonstrate typical joints, surface finish, texture, tolerances, and standard of workmanship.
   1. Build panel approximately 200 sq. ft. for slab-on-grade in the location indicated or, if not indicated, as directed by Architect.
   2. Approved panels may become part of the completed Work if undisturbed at time of Substantial Completion.

B. Preinstallation Conference: Conduct conference at Project site.
   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.

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, joint-filler strips, semirigid joint fillers, forms and form removal limitations, shoring and reshoring procedures, vapor-retarder installation, anchor rod and anchorage device installation tolerances, steel reinforcement installation, floor and slab flatness and levelness measurement, concrete repair procedures, and concrete protection.

1.4 SUBMITTALS

A. LEED Submittals:
   1. Coordinate with Division 01 specifications for all LEED submittal requirements.

B. Design Mixtures:
   1. Indicate amounts of mixing water to be withheld for later addition at Project site.

C. Cold-Weather Placement: Submit detailed procedures for cold weather concreting in accordance with ACI 306.1.

D. Hot-Weather Placement: Submit detailed procedures for hot weather concreting in accordance with ACI 305.1.

E. 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.

F. Formwork layout and dimension shop drawings.

G. Material Test Reports: For the following, from a qualified testing agency, indicating compliance with requirements:
   1. Aggregates

H. Material Certificates: For each of the following as applicable on the project, signed by manufacturers:
   1. Cementitious materials.
   2. Admixtures.
   3. Form materials and form-release agents.
   4. Steel reinforcement and accessories.
   5. Curing compounds.
   6. Floor and slab treatments.
   8. Adhesives.
   9. Vapor retarders.
   10. Semirigid joint filler.
   12. Repair materials.

I. Floor surface flatness and levelness measurements to determine compliance with specified tolerances.

J. Minutes of preinstallation conference.
1.5 INFORMATION SUBMITTALS

A. Formwork Shop Drawings: Signed and sealed by a Licensed Design Engineer in the state in which the project is located.
   1. Calculations for Formwork, Shoring, Re-shoring, and Back-shoring: Signed and sealed by a Licensed Design Engineer in the state in which the project is located.

B. Embed and Penetration Plans: Submit placing drawings that detail locations of mechanical, electrical, plumbing, and fire protection openings, sleeves and embedded accessories not specifically located on the Structural Construction Drawings, including routing of embedded conduit.

PART 2 - PRODUCTS

2.1 FORM-FACING MATERIALS

A. Comply with ACI 301.

B. Earth forms may be used for footing forms where sides of the excavation are cut true, in firm soil. If earth is not suitable to be used as “earth form,” no consideration will be given to any claim for additional cost of formwork. Contractor shall provide material and labor to provide formwork without additional cost to Owner.

2.2 STEEL REINFORCEMENT

A. Recycled Content of Steel Products: Coordinate with Division 01 specifications for all LEED recycled content requirements.

B. Reinforcing Bars: ASTM A 615 Grade 60 deformed.

C. Low-Alloy-Steel Reinforcing Bars: ASTM A 706 Grade 60 deformed.
   1. For use where weldable reinforcing is called out in construction documents.

D. Reinforcing bars resisting earthquake-induced flexural and/or axial forces shall be ASTM A 706 Grade 60 deformed.
   1. For use where special seismic reinforcing is called out in construction documents.
   2. ASTM A615 Grade 60 deformed is permitted if all of the following conditions are satisfied:
      a. Actual yield strength based on mill tests does not exceed fy by more than 18,000 psi.
      b. Ratio of the actual tensile strength to the actual yield strength is at least 1.25.
      c. Minimum elongation in 8 in. shall be at least 14 percent for bar sizes No. 3 through No. 6, at least 12 percent for bar sizes No. 7 through No. 11, and at least 10 percent for bar sizes No. 14 and No. 18.

E. Plain-Steel Welded Wire Reinforcement: ASTM A 1064, plain, fabricated from as-drawn steel wire into flat sheets.

F. Headed Concrete Anchors: Conform to AWS D1.1 and ASTM A 108 specifications for 1010 through 1020 mild steels, type B. Minimum yield strength = 51,000 psi (0.2 % offset).
2.3 REINFORCEMENT ACCESSORIES

A. Joint Dowel Bars: ASTM A 615, Grade 60, plain-steel bars, cut true to length with ends square and free of burrs.

B. Bar Supports: Manufacture bar supports from plastic, or precast concrete according to CRSI's "Manual of Standard Practice," of greater compressive strength than concrete for use in foundations and slabs-on-grade only.

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 or II. Supplement with the following:
      a. Fly Ash: ASTM C 618, Class F or C.
      b. Ground Granulated Blast-Furnace Slag: ASTM C 989, Grade 100 or 120.
      c. Use of supplemental cementitious materials may be rejected by Architect/Structural Engineer of Record for certain applications on project.
   2. Blended Hydraulic Cement: ASTM C 595, Type IS Portland blast-furnace slag, Type IP Portland-pozzolan, Type I (PM) pozzolan-modified Portland, Type I (SM) slag-modified Portland cement. Use of blended hydraulic cement may be rejected by Architect/Structural Engineer of Record for certain applications on project.

B. Silica Fume: ASTM C 1240, amorphous silica. Use of blended hydraulic cement may be rejected by Architect/Structural Engineer of Record for certain applications on project.

C. Normal-Weight Aggregates: ASTM C 33, coarse aggregate or better, graded. Select grading class per type of construction or location used, and in relation to specific weathering region. Provide aggregates from a single source.

D. Water: Shall be potable.

2.5 ADMIXTURES


B. Chemical Admixtures: Provide admixtures certified by manufacturer to be compatible with other admixtures and that will not contribute water-soluble chloride ions exceeding those permitted in hardened concrete. Do not use calcium chloride or admixtures containing calcium chloride.
   1. Water-Reducing Admixture: ASTM C 494/C 494M, Type A.
   2. Retarding Admixture: ASTM C 494/C 494M, Type B.
   3. Water-Reducing and Retarding Admixture: ASTM C 494/C 494M, Type D.
   4. High-Range, Water-Reducing Admixture: ASTM C 494/C 494M, Type F.
   5. High-Range, Water-Reducing and Retarding Admixture: ASTM C 494/C 494M, Type G.
   6. Plasticizing and Retarding Admixture: ASTM C 1017/C 1017M, Type II.

2.6 VAPOR RETARDERS

A. Sheet Vapor Retarder meeting ASTM E 1745, minimum 10 mil thickness. Coordinate with Division 03 and 07 specifications and Architectural Drawings for additional requirements or increased thickness. See Construction Drawings for locations required. Install per qualified geotechnical engineer’s recommendation and ACI 302.1 requirements.
2.7 CONCRETE MIXTURES, GENERAL

A. Prepare design mixtures for each type and strength of concrete, proportioned on the basis of laboratory trial mixture or field test data, or both, according to ACI 301 and ACI 318 chapter 5. Design mixtures shall meet the minimum requirements tabulated in the construction documents.

B. Cementitious Materials: Use fly ash, pozzolan, ground granulated blast-furnace slag, and silica fume as needed to coordinate with Division 01 specifications for all LEED recycled content requirements. Limit percentage, by weight, of cementitious materials other than Portland cement in concrete per ACI 301 requirements for concrete exposed to deicing chemicals. Requirements of table 4.2.2.1 of ACI 301 shall be adhered to.

C. Admixtures: Use admixtures according to manufacturer's written instructions.
   1. Use water-reducing, high-range water-reducing, plasticizing, or retarding admixtures in concrete, as required, for placement and workability, and project specific conditions.

2.8 CONCRETE MIXING

A. Ready-Mixed Concrete:
   1. When air temperature is between 85 and 90 deg F, reduce mixing and delivery time from 90 minutes 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. Limit concrete surface irregularities, designated by ACI 347R as abrupt or gradual, as follows:
   1. Class A, 1/8 inch for exposed smooth-formed finished surfaces.
   2. Class B, 1/4 inch for exposed rough-formed finished surfaces.

3.2 STEEL REINFORCEMENT

A. General: Comply with CRSI's "Manual of Standard Practice" for placing reinforcement.

B. Field bending or straightening of reinforcing bars partially embedded in concrete is prohibited unless specifically permitted by Structural Engineer of Record. Comply with ACI 301 procedures for field bending and straightening.

C. Install welded wire reinforcement in longest practicable lengths on bar supports spaced to minimize sagging. Lap edges and ends of adjoining sheets at least two full panels. Offset laps of adjoining sheet widths to prevent continuous laps in either direction. Lace overlaps with wire.

3.3 CONCRETE PLACEMENT

A. Do not add water to concrete during delivery or at Project site. Add water at project site only as noted on delivery ticket, and prior to beginning placement.

B. Cold-Weather Placement: Comply additionally with ACI 306.1 and as follows:
1. Do not use calcium chloride, salt, or other materials containing antifreeze agents or chemical accelerators unless otherwise specified and approved in mixture designs.

C. Hot-Weather Placement: Comply additionally with ACI 305.1 and as follows:
   1. Chilled mixing water or chopped ice may be used to control temperature, provided water equivalent of ice is calculated to total amount of mixing water.

3.4 FINISHING FLOORS AND SLABS

A. General: Comply with ACI 302.1R recommendations for screeding, re-straightening, and finishing operations for concrete surfaces. Do not wet concrete surfaces.

B. Float Finish:
   1. Apply float finish to surfaces to receive trowel finish and to be covered with fluid-applied or sheet waterproofing, built-up or membrane roofing, or sand-bed terrazzo.

C. Trowel Finish (after applying float finish):
   1. Apply a trowel finish to surfaces exposed to view or to be covered with resilient flooring, carpet, ceramic or quarry tile set over a cleavage membrane, paint, or another thin-film-finish coating system.
   2. Finish surfaces to the following tolerances, according to ASTM E 1155, for a randomly trafficked floor surface:
      a. Specified overall values of flatness, F(F) 35; and of levelness, F(L) 25; with minimum local values of flatness, F(F) 24; and of levelness, F(L) 17; for slabs-on-grade.

D. Trowel and Fine-Broom Finish:
   1. Apply a trowel finish to surfaces where ceramic or quarry tile is to be installed by either thickset or thin-set method.
   2. Comply with flatness and levelness tolerances for trowel-finished floor surfaces.

E. Broom Finish: Apply a broom finish to exterior concrete platforms, steps and ramps, and elsewhere as indicated.
   1. Coordinate required final finish with Architect before application.

F. Slip-Resistive Finish: Before final floating, apply slip-resistive finish where indicated and to concrete stair treads, platforms, and ramps. Apply according to manufacturer's written instructions and as follows:
   1. Uniformly spread 25 lb/100 sq. ft. of dampened slip-resistive material over surface in 1 or 2 applications. Tamp aggregate flush with surface, but do not force below surface.
   2. After broadcasting and tamping, apply float finish.
   3. After curing, lightly work surface with a steel wire brush or an abrasive stone and water to expose slip-resistive material.

3.5 CONCRETE PROTECTING AND CURING

A. General: Protect freshly placed concrete from premature drying and excessive cold or hot temperatures. Comply with ACI 301, ACI 305, ACI 306, and ACI 306.1 as applicable.

B. Cure concrete according to ACI 308.1, by one or a combination of the methods allowed in ACI 301.
3.6 CONCRETE SURFACE REPAIRS

A. Defective Concrete: Repair and patch defective areas when approved by Architect/Structural Engineer of Record. Remove and replace concrete that cannot be repaired and patched to Architect/Structural Engineer of Record approval.

B. 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 per ACI 301, to the satisfaction of the Architect/Structural Engineer of Record.

C. Repairing Unformed Surfaces: Test unformed surfaces, such as floors and slabs, for finish and verify surface tolerances specified for each surface. For areas out of tolerance or specification, Contractor shall propose correction method to Architect/Structural Engineer of Record for approval.

3.7 FIELD QUALITY CONTROL

A. 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 at least one composite sample set for each 75 cu. yd. or fraction thereof of each concrete mixture placed each day.
      a. When frequency of testing will provide fewer than five compressive-strength tests for each concrete mixture, testing shall be conducted from at least five randomly selected batches or from each batch if fewer than five are used.
   2. Slump: ASTM C 143; one test at point of delivery for each composite sample, but not less than one test for each day's pour of each concrete mixture. Perform additional tests when concrete consistency appears to change.
   3. 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.
   4. Air Content: ASTM C231 or ASTM C173 as applicable, one test for each composite sample, but not less than one test for each day's pour of each concrete mixture.
      a. Cast and cure a minimum of four 6"x12" or five 4"x8" cylinder specimens for each composite sample.
      b. Additional cylinders to be cast for high-early strength concrete and as required for contractor's means and methods.
   6. Compressive-Strength Tests: ASTM C 39; test one specimen at 7 days and one set of two (6"x12")/three (4"x8") specimens at 28 days. Should 28 day strength not be met, test remaining cylinder at 56 days. Should 28 day strength be met, remaining cylinder may be discarded. Additional tests for high-early strength concrete and as required for contractor's means and methods.

B. Measure floor and slab flatness and levelness according to ASTM E 1155 as soon as possible but within 24 hours of finishing. Elevated framing shall be measured in its shored condition (where applicable).

END OF SECTION
SECTION 04 0513
MASONRY MORTARING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Mortar for masonry.

B. Related Sections:
   1. Division 01 - Administrative, procedural, and temporary work requirements.
   2. Section 04 7300 – Simulated Stone
   3. Section 07 2113 – Board Insulation
   4. Section 07 2800 – Moisture Barriers

1.2 REFERENCES

A. ASTM International (ASTM):

1.3 SUBMITTALS

A. Product data: Submit manufacturer’s specifications, installation instructions, and general recommendations for each major product required. Include data substantiating that products to be furnished comply with requirements of the contract documents. Mark manufacturer's brochures to include only those products proposed for use.

B. Quality Control Submittals:
   1. Test reports: Indicating mortar compliance with ASTM C270.

1.4 DELIVERY, STORAGE AND HANDLING

A. Deliver preblended mortar in manufacturer's original, unopened packages or containers.

B. Protect materials from moisture absorption and damage; reject damaged containers.

C. Store aggregate to prevent inclusion of foreign matter.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Acceptable Manufacturers - Preblended Mortars and Grouts:
   1. Quikrete Companies. (www.quikrete.com)
   2. Mapei Corporation (www.mapei.com)
   3. LaFarge-Holcim (www.lafargeholcim.us)
   4. Amerimix (www.amerimix.com)

B. Substitutions: Under provisions of Division 01.
2.2 MATERIALS

A. Polymer Modified Stone Veneer Mortar
1. Scratch Coat Mortar: Preblended, ASTM C270, Type S.
2. Setting Bed Mortar: Preblended, ANSI A118.15, Type S.

B. Water: Clean and free from oils, acids, alkalies, organic matter, and other substances in amounts deleterious to mortar or metals in masonry.

2.3 MIXING

A. Mix mortar in accordance with ASTM C270.

B. Dry Preblended Mortar:
1. Mix using continuous, self-cleaning mixer mounted at apex of silo cone.
2. Set water flow valve to provide workable consistency.

C. Thoroughly mix ingredients in quantities needed for immediate use.

D. Discard lumpy, caked, frozen, and hardened mixes.

E. Mortar may be retempered by adding water as required. Use mortar within 2-1/2 hours after initial mixing at ambient temperatures below 80 degrees F and within 1-1/2 hours after initial mixing at ambient temperatures over 80 degrees F.

F. Do not add accelerators, retarders, water repellents, antifreeze compounds, or other additives without Architect’s approval.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates upon which work will be installed.

B. Coordinate with responsible entity to perform corrective work on unsatisfactory substrates.

C. Commencement of work by installer is acceptance of substrate.

3.2 PREPARATION

A. Protection: Protect adjacent work from contact with mortar.

B. Surface Preparation: Prepare substrate in accordance with manufacturer’s installation instructions for the type of substrate being covered.

3.3 INSTALLATION

A. Install and clean stone in accordance with manufacturer’s installation instructions for Jointless/Dry-Stacked installation.

3.4 CLEANING

A. Remove protective coverings from adjacent work.

B. Cleaning Veneer Units:
1. Wash with soft bristle brush and water/granulated detergent solution
2. Rinse immediately with clean water

C. Removing Efflorescence:
   1. Allow veneer to dry thoroughly
   2. Scrub with soft bristle brush and clean water
   3. Rinse immediately with clean water; allow to dry

APPENDIX – SCHEDULE OF SUBMITTALS

<table>
<thead>
<tr>
<th>Submittal Number</th>
<th>Item Number</th>
<th>Description</th>
<th>Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td>04 0513</td>
<td>Masonry Mortaring</td>
<td>Submittal</td>
<td></td>
</tr>
<tr>
<td></td>
<td>04 0513-1.3-A-01</td>
<td>Product Data – Scratch Coat Mortar</td>
<td></td>
</tr>
<tr>
<td></td>
<td>04 0513-1.3-A-02</td>
<td>Product Data – Setting Coat Mortar</td>
<td></td>
</tr>
</tbody>
</table>

END OF SECTION
PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Simulated stone veneer over metal lath and setting mortar.
   2. Pointing mortar joints.

B. Related Sections:
   1. Division 01 - Administrative, procedural, and temporary work requirements.
   2. Section 04 0513 - Masonry Mortaring.
   3. Section 05 4000 - Cold-Formed Metal Framing
   4. Section 06 1643 – Sheathing.
   5. Section 07 2800 – Moisture Barriers.
   6. Section 07 6200 – Sheet Metal Flashing & Trim
   7. Section 07 9200 - Joint Sealers.

1.2 REFERENCES

A. ASTM International (ASTM):

B. Masonry Veneer Manufacturers Association (MVMA) - Installation Guide for Adhered Manufactured Stone Veneer.

1.3 SUBMITTALS

A. Shop Drawings: Submit drawings depicting proper installation and flashing techniques. Coordinate locations with those found on the Drawings.

B. Product Data: Include manufacturer’s detailed material and system description, installation instructions, engineering performance data and finish specifications. Mark manufacturer’s brochures to include only those products proposed for use.

C. Samples:
   1. Full size stone samples showing profile and finish.
   2. Samples to exhibit the full color range to be provided.

D. Closeout Submittals: Provide manufacturer’s maintenance instructions that include recommendations for cleaning and repair of components.

1.4 QUALITY ASSURANCE

A. Manufacturer Qualifications: Manufacturer who is a current member of Masonry Veneer Manufactures Association (MVMA) with a minimum of 5 years documented experience manufacturing and marketing all Manufactured Stone products of the type specified in this section.
B. Installer's qualifications: Minimum 10 years experience in work of this Section.

C. Mockup:
   1. Size: Minimum 4 feet high x 8 feet wide.
   2. Show:
      a. Stone color and texture range.
      b. Mortar joint size, color, and profile.
      c. Bond pattern.
      d. Trim units.
      e. Transition to adjacent materials anticipated.
   3. Locate where directed.
   4. Approved mockup may remain as part of the Work.


E. Pre-Installation Conference:
   1. Contractor shall arrange a meeting not less than thirty days prior to starting stone veneer work.
   2. Attendance: Contractor, Architect/Owner Representative, veneer stone installer and manufacturer's representative.

1.5 DELIVERY, STORAGE AND HANDLING

A. Store and handle products in conformance with the manufacturer's requirements and recommendations.

B. Store materials in a manner that protects from exposure to harmful weather conditions, damage or staining.

C. Store products off the ground on pallets in manufacturer's unopened packaging until ready for installation.

D. Protect materials from precipitation and freezing temperatures. Product with visible frozen moisture should not be installed.

1.6 PROJECT/SITE 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.

B. Cold weather installations: Maintain materials and ambient temperature at minimum 40 degrees F (4 degrees C) prior to, during, and 48 hours after installation.

C. Hot weather installations: Mist water on the scratch coated surface and the backs of the masonry veneer for installations that exceed 90 degrees (32 degrees C).

1.7 WARRANTY

A. Provide manufacturers 50-year limited warranty against defects in materials and workmanship.

PART 2 - PRODUCTS

2.1 MANUFACTURERS:
A. Acceptable Manufacturers – Simulated Stone:
   2. Echelon, an Oldcastle Company. (www.echelonmasonry.com)
   3. Coronado Products, Inc. (www.coronado.com)

B. Acceptable Manufacturers - Metal Lath:
   1. Alabama Metal Industries Corp. (www.amico-grating.com)
   2. CEMCO / California Expanded Products Co. (www.cemcosteel.com)
   3. Marino Ware Industries. (www.marinoware.com)

C. Substitutions: Under provisions of Division 01.

2.2 MATERIALS:

A. Simulated Stone:
   1. Basis of design: Platinum Pro-Fit Ledgestone by Boral.
   2. Performance Requirements: Conforming to ASTM C 1670 and as follows:
      a. Compressive Strength: Not less than 1800 psi (12.4 MPa) average for 5
         specimens and not less than 2100 psi (14.4 MPa) for individual specimen when
         tested in accordance with ASTM C 39 & ASTM C 192.
      b. Bond Between Manufactured Masonry Unit, Mortar and Backing: Not less than
         50 psi (345 kPa) when tested in accordance with ASTM C 482 using Type S
         mortar.
      c. Thermal Resistance: R-value of not less than 0.355 per inch (25.4 mm) of
         thickness when tested in accordance with ASTM C 177.
      d. Freeze/Thaw: No disintegration and less than 3 percent weight loss when tested
         in accordance with ASTM C 67.
      e. Water Absorption: Tested in accordance with UBC 15-5 9-22% depending on
         density value.
      f. Unit Weight: Not more than 15 psf (73 kg/m2) saturated.
      g. Surface Burning Characteristics: Not more than the following when tested in
         accordance with UL 723:
         1) Flamespread: 25.
         2) Smoke Development: 450.
         3) UV Stable - Mineral oxide pigments.
   3. Provide with Blended Color / Texture specified.
   4. Special Shapes:
      a. Color to match stones specified.
      b. Provide Stones manufactured specifically for installation at corners where located
         on the Drawings.

2.3 ACCESSORIES

A. Mortar: Specified in Section 04 0513.

B. Metal Lath:
   1. ASTM C847, self-furring diamond mesh weighing 2.5 pounds per square foot high rib,
      3/8 inch high, galvanized.

C. Fasteners: Hot dip galvanized steel, self-tapping screws with sufficient length to penetrate 3/8
   inch (9.5 mm) through metal studs.

D. Cleaner: Type recommended by stone manufacturer.

PART 3 - EXECUTION
3.1 **EXAMINATION**

A. Do not begin installation until substrates have been properly prepared in conformance with ASTM C 1780 for the backup wall system indicated on the Drawings.

B. Verify that stud spacing does not exceed 16 inches o.c.

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 OF METAL LATH**

A. Perform Work in accordance with ASTM C1063.

B. Apply with long dimension perpendicular to supports, with end joints staggered and occurring over supports.

C. Lap ends minimum 1 inch at vertical seams and 1/2 inches at horizontal seams. Vertical seams should be staggered.

D. Lath should be wrapped around inside and outside corners a minimum of 12 inches.

E. Fasten to framing at maximum 6 inches on center vertically.

F. Stop lath at each side of expansion and control joints and secure.

3.4 **INSTALLATION OF STONE**

A. Install stone in accordance with ASTM C1780, MVMA Installation Guide, and manufacturer’s instructions.

B. Blend stone from multiple boxes before installing.

C. Stone Direction: Horizontal placement.

D. Windows, Doors & Wall Openings:
   1. Butt field stones to wall opening.
   2. Install specified trim stones where located on the Contract Drawings.

E. Sills: Install Sills where located on the Drawings.

F. Caps: Install Capstones where located on the Drawings.

G. Apply mortar to minimum 3/4 inch thickness to completely cover lath. Allow mortar to cure minimum 48 hours.

H. Apply 3/8 inch thick mortar completely covering back of each stone.

I. Place stone in random coursed ashlar pattern.

J. Arrange stone pattern to provide varied color throughout.

K. Set stone plumb and level.
L. Press stone to full contact with mortar.

M. Place stone with dry stack joints.

N. Seal all joints at wall openings and penetrations with a sealant approved for use with masonry products.

O. Flashing: Coordinate with Flashings specified in Section 07 62 00 - Sheet Metal Flashing & Trim.

3.5 CLEANING & PROTECTION

A. Clean stone with detergent and water applied with fiber brush.

B. If initial cleaning does not produce acceptable results, apply cleaner in accordance with manufacturer’s instructions.
   1. Protect adjacent surfaces.
   2. Thoroughly rinse surfaces with clean water after completion of cleaning; remove all traces of cleaning solution.

C. Protect finished work from rain and work on either side of the wall during and for 48 hours following installation.

D. Protect installed products until completion of project.

E. Final clean prior to project closeout.

F. Touch-up, repair or replace damaged products before Substantial Completion.

APPENDIX – SCHEDULE OF SUBMITTALS

<table>
<thead>
<tr>
<th>Submittal Number</th>
<th>Item Number</th>
<th>Description</th>
<th>Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td>04 7300</td>
<td>04 7300-1.3-A-01</td>
<td>Shop Drawings</td>
<td></td>
</tr>
<tr>
<td></td>
<td>04 7300-1.3-B-01</td>
<td>Product Data – Simulated Stone</td>
<td></td>
</tr>
<tr>
<td></td>
<td>04 7300-1.3-B-02</td>
<td>Product Data – Metal Lath</td>
<td></td>
</tr>
<tr>
<td></td>
<td>04 7300-1.3-B-03</td>
<td>Product Data - Cleaner</td>
<td></td>
</tr>
<tr>
<td></td>
<td>04 7300-1.3-C-01</td>
<td>Samples – Simulated Stone</td>
<td>Requested by Architect only if not providing basis of design items</td>
</tr>
<tr>
<td></td>
<td>04 7300-1.3-D-01</td>
<td>Maintenance Data</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td><strong>Project Close-Out Documentation</strong></td>
<td>Provide at date of material completion</td>
</tr>
</tbody>
</table>

END OF SECTION
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. Description:
   1. This section includes elements of the structural-steel frame, as classified by AISC 303, "Code of Standard Practice for Steel Buildings and Bridges."
   2. This section does not include Miscellaneous Metal Fabrications.

B. Related Documents and Standards:
   1. All referenced standards and cited publications shall be those specifically denoted within the applicable building code noted in the General Notes of the Construction Drawings.
   2. All Structural Steel work on this project shall conform to the Construction Documents, applicable building code including referenced standards, and the requirements of AISC360 “Specification for Structural Steel Buildings”, RCSC “Specification for Structural Joints Using High-Strength Bolts”, and AISC303 “Code of Standard Practice for Steel Buildings and Bridges” in coordination with clarifications, exemptions, and additions in the Construction Documents. Where required by code and as denoted in the Construction Documents, Seismic Detailing shall conform to the requirements of AISC341 “Seismic Provisions for Structural Steel Buildings.”

C. Related Sections:
   1. Division 05 Specifications – Steel Construction.
   2. Division 09 Specification – Finishes

1.3 QUALITY ASSURANCE

A. Fabricator Qualifications: A qualified fabricator that participates in the AISC Quality Certification Program and is designated an AISC-Certified Plant.

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

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

D. Preinstallation Conference: Conduct conference at Project Site.

E. Land Surveyor Qualifications: A professional land surveyor who is legally qualified to practice in jurisdiction where Project is located and with a minimum of five years of experience in providing surveying services of the kind indicated.
1.4 PERFORMANCE REQUIREMENTS

A. Connections: Provide details of connections required by the Construction Documents to be selected or completed by structural-steel fabricator, including comprehensive engineering design by a registered design professional licensed in the state in which the project is located, to withstand loads indicated and comply with other information and restrictions indicated.

1. An experienced steel detailer shall select or complete standard connections using schematic details and loads indicated in Construction Drawings as per “Option 2” of AISC 303.

2. Non-standard connections shall be designed by a registered design professional licensed in the state in which the project is located working for the steel fabricator, using schematic details and loads indicated in Construction Drawings as per “Option 3” of AISC 303.

3. Use ASD; data are given at service-load level.

4. Where beam shear is not noted, the connections shall develop the beam shear $V = W/2$ where $W$ is the total allowable beam uniform load based on laterally supported simple span moments per tables located in the AISC Manual of Steel Construction.

1.5 SUBMITTALS

A. LEED Submittals:

1. Coordinate with Division 01 specifications for all LEED submittal requirements.

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

1. Include details of cuts, connections, splices, camber, holes, and other pertinent data.

2. Include embedment drawings.

3. Indicate welds by standard AWS symbols, distinguishing between shop and field welds, and show size, length, and type of each weld. Show backing bars that are to be removed and supplemental fillet welds where backing bars are to remain.

4. Indicate type, size, and length of bolts, distinguishing between shop and field bolts. Identify pretensioned and slip-critical high-strength bolted connections.

5. For structural-steel connections indicated to comply with design loads, include structural design data signed and sealed by the registered design professional licensed in the state where the project is located, who is responsible for their preparation.

6. Shop drawings that include elements designed by the fabricator shall be signed and sealed by a registered design professional licensed in the state where the project is located. Alternately, the fabricator may submit a signed and sealed cover letter with the shop drawings substantiating the design information. The design engineer shall review and confirm in writing that the shop and erection drawings properly incorporate their design.

C. Qualification Data: For qualified Installer and Fabricator.

D. Welding certificates.

E. Material (Mill) test reports for structural steel, including chemical and physical properties.

F. Product Test Reports: For the following:

1. Bolts, nuts, and washers including mechanical properties and chemical analysis.

2. Direct-tension indicators.

3. Tension-control, high-strength bolt-nut-washer assemblies.

4. Steel headed stud anchors (shear connectors/shear studs).

5. Shop primers.

G. Source quality-control reports.

H. Surveys:
   1. Submit survey indicating elevations and locations of concrete and masonry bearing surfaces and locations of anchor rods, bearing plates, and other embedments to receive structural framing. Indicate discrepancies between actual installation and the Contract Documents.
   2. Submit survey indicating final elevations and locations of columns and other major structural steel elements. Steel survey shall include column plumbness after structural steel erection. Indicate discrepancies between actual installation and the Contract Documents. Surveyor who performed the surveys shall certify their accuracy.

I. Fabricator’s Certificate of Compliance: For each approved fabricator that is exempt from Special Inspections of shop fabrications and implementation procedures in accordance with Section 1704.2.5.2 of the Building Code, the Contractor shall submit “Fabricator’s Certificate of Compliance.” Contractor shall also provide copies of fabricator’s certification or building code evaluation services report and fabricator’s quality control manual.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Store materials to permit easy access for inspection and identification. Keep steel members off ground and spaced by using pallets, dunnage, or other supports and spacers. Protect steel members and packaged materials from corrosion and deterioration.
   1. Do not store materials on structure in a manner that might cause distortion, damage, or overload to members or supporting structures. Repair or replace damaged materials or structures as directed.

B. Store fasteners in a protected place in sealed containers with manufacturer’s labels intact.
   1. Fasteners may be repackaged provided Owner’s testing and inspecting agency observes repackaging and seals containers.
   2. Clean and re-lubricate bolts and nuts that become dry or rusty before use.
   3. Comply with manufacturers’ written recommendations for cleaning and lubricating ASTM F 1852 fasteners and for retesting fasteners after lubrication.

1.7 COORDINATION

A. Coordinate selection of shop primers with topcoats to be applied over them. Comply with paint and coating manufacturers’ recommendations to ensure that shop primers and topcoats are compatible with one another.

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

C. All Structural Steel not receiving fire-proofing shall receive one shop coat of rust-inhibitive primer. All steel with exterior exposure shall be painted with a double coat of rust prohibitive epoxy primer (material and thickness to be specified by Architect) unless noted as galvanized or architecturally exposed structural steel.
PART 2 - PRODUCTS

2.1 STRUCTURAL-STEEL MATERIALS

A. Recycled Content of Steel Products: Coordinate with Division 01 specifications for all LEED recycled content requirements.

B. Provide Structural Steel materials meeting the standards and grades set forth in the Construction Drawings.

2.2 BOLTS, CONNECTORS, AND ANCHORS

A. Provide Bolts, Connectors, and Anchors of materials meeting the standards and grades set forth in the Construction Drawings.

2.3 GROUT

A. Non-metallic, Shrinkage-Resistant Grout: ASTM C 1107, factory-packaged, non-metallic aggregate grout, non-corrosive and non-staining, mixed with water to consistency suitable for application and a 30-minute working time.

2.4 FABRICATION

A. Structural Steel: Fabricate and assemble in shop to greatest extent possible. Fabricate according to AISC’s "Code of Standard Practice for Steel Buildings and Bridges" and AISC 360.
   1. Camber structural-steel members where indicated.
   2. Fabricate beams with rolling camber up.
   3. Mark and match-mark materials for field assembly.
   4. Complete structural-steel assemblies, including welding of units, before starting shop-priming operations.

B. Holes: Provide holes required for securing other work to Structural Steel
   1. Provide holes for other work to pass through steel framing members only as shown in Structural Construction Drawings.
   2. Cut, drill, or punch holes perpendicular to steel surfaces. Do not thermally cut bolt holes or enlarge holes by burning.
   3. Base Plate Holes: Cut, drill, or punch holes perpendicular to steel surfaces.

2.5 SHOP CONNECTIONS

A. High-Strength Bolts: Shop install high-strength bolts according to RCSC’s "Specification for Structural Joints Using High Strength Bolts" for type of bolt and type of joint specified in the Construction Drawings.

B. Weld Connections: Comply with AWS D1.1 for tolerances, appearances, welding procedure specifications, weld quality, and methods used in correcting welding work.
2.6 PRIMER PAINT

A. Fabricator’s standard rust-inhibiting grey primer. Do not prime steel that is to receive fire-proofing spray. Provide finish where indicated on Construction Drawings (see Architectural Drawings and Division 09 specifications).

1. Level One finish:
   a. Clean surfaces to be primed of loose mill scale, rust, dirt, oil, grease, and other matter precluding paint bond. Follow procedures of SSPC-SP6 brush-off blast cleaning, supplemented by SSPC-SP3 power tool cleaning and SSPC-SP1 solvent cleaning.
   b. Prime structural steel and secondary framing members with manufacturer’s standard rust-inhibitive gray color primer.

2. Level Two finish: Same as Level One with following addition. Remove slag and rough areas, fill pits and remove paint runs.

2.7 GALVANIZING

A. Hot-Dip Galvanized Finish: Apply zinc coating by the hot-dip process to Structural Steel according to ASTM A 123.

1. Fill vent and drain holes that will be exposed in the finished Work unless they will function as weep holes, by plugging with zinc solder and filing off smooth.

2. Galvanize lintels, shelf angles, any framing exposed to earth or weather, and other framing as noted in the Construction Drawings.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify, with Steel Erector present, elevations of concrete- and masonry-bearing surfaces and locations of anchor rods, bearing plates, and other embedments for compliance with requirements.

1. Prepare a certified survey of bearing surfaces, anchor rods, bearing plates, and other embedments showing dimensions, locations, angles, and elevations.

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

C. Before erection begins, survey elevations and plan locations of concrete and masonry bearing surfaces and locations of anchor rods, bearing plates, and other embedments to receive structural framing, with Erector present, for compliance with requirements and specified tolerances.

1. Engage Land Surveyor to perform surveying.

2. Survey submittals shall indicate elevations and plan locations, and discrepancies between actual installation and Contract Documents.

3. Connections to surveyed items cannot be made until submittal has been reviewed by the Design Professional and unsatisfactory conditions have been corrected.

D. As erection proceeds, survey final elevations and plan locations of columns, beams, and other major structural steel elements for compliance with requirements and specified tolerances.

1. Engage Land Surveyor to perform surveying.

2. Steel frame survey submittals shall indicate final elevations and plan locations of columns, beams, and other major framing, as well as column plumbness. Indicate discrepancies between actual installation and the Contract Documents.
3. Placement or application of other materials which might obscure or restrain surveyed elements cannot be made until submittal has been reviewed by the Design Professional and 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, bracing, and diaphragms are in place unless otherwise indicated.

3.3 ERECTION

A. Set Structural Steel accurately in locations and to elevations indicated and according to AISC 303 and AISC 360.

   1. Set plates for structural members on wedges, shims, or setting nuts as required.
   2. Weld plate washers to top of base plate where noted as required in Construction Drawings.
   3. Snug-tighten anchor rods after supported members have been positioned and plumbed. Do not remove wedges or shims but, if protruding, cut off flush with edge of plate before packing with grout.
   4. Promptly pack grout solidly between bearing surfaces and plates so no voids remain. Neatly finish exposed surfaces; protect grout and allow to cure. Comply with manufacturer's written installation instructions for shrinkage-resistant grouts.

C. Maintain erection tolerances of Structural Steel within AISC's "Code of Standard Practice for Steel Buildings and Bridges."

D. Align and adjust various members that form part of complete frame or structure before permanently fastening. Before assembly, clean bearing surfaces and other surfaces that will be in permanent contact with members. Perform necessary adjustments to compensate for discrepancies in elevations and alignment.
   1. Level and plumb individual members of structure.
   2. Make allowances for difference between temperature at time of erection and mean temperature when structure is completed and in service.

E. Splice members only where indicated.

F. Do not use thermal cutting during erection.

G. Do not enlarge unfair holes in members by burning or using drift pins. Ream holes that must be enlarged to admit bolts.

H. Shear Connectors: Prepare steel surfaces as recommended by manufacturer of shear connectors. Use automatic end welding of headed-stud shear connectors according to AWS D1.1 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 High-Strength Bolts” for type of bolt and type of joint specified in the Construction Drawings.

B. Weld Connections: Comply with AWS D1.1 for tolerances, appearances, welding procedure specifications, weld quality, and methods used in correcting welding work.
   1. Comply with AISC 303 and AISC 360 for bearing, alignment, adequacy of temporary connections, and removal of paint on surfaces adjacent to field welds.
   2. Remove backing bars or runoff tabs, back gouge, and grind steel smooth.

3.5 REPAIRS AND PROTECTION

A. Galvanized Surfaces: Clean areas where galvanizing is damaged or missing and repair galvanizing to comply with ASTM A 780.

B. Touchup Painting: Immediately after erection, clean exposed areas where primer is damaged or missing and paint with the same material as used for shop painting to comply with SSPC-PA 1 for touching up shop-painted surfaces.
   1. Clean and prepare surfaces by SSPC-SP 2 hand-tool cleaning or SSPC-SP 3 power-tool cleaning.

C. Touchup Painting: Cleaning and touchup painting are specified in Division 09 painting Sections.

END OF SECTION
SECTION 05 3100
STEEL DECK

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. Description:
   1. This section includes Roof Deck.
B. Related Documents and Standards:
   1. All referenced standards and cited publications shall be those specifically denoted within the applicable building code noted in the General Notes of the Construction Drawings.
   2. All Steel Deck work on this project shall conform to the Construction Documents, applicable building code including referenced standards, and the requirements of Steel Deck Institute’s (SDI) “Standard Specification” and “Code of Standard Practice.”
C. Related Sections:
   1. Division 05 Specifications – Steel Construction.
   2. Division 09 Specification – Finishes

1.3 QUALITY ASSURANCE
B. 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.”
D. NOA Listing: Provide Decking, Fasteners, and roof material in accordance with NOA #09-1013.05

1.4 SUBMITTALS
A. Product Data: For each type of deck, accessory, and product indicated on Construction Drawings and/or Shop Drawings.
B. LEED Submittals:
   1. Coordinate with Division 01 specifications for all LEED submittal requirements.
C. 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.

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 MATERIALS

A. Recycled Content of Steel Products: Coordinate with Division 01 specifications for all LEED recycled content requirements.

2.2 ROOF DECK

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. 31, and with the following:
   1. Coordinate additional requirements with Construction Drawing General Notes and plan notes.

2.3 ACCESSORIES

A. General: Provide manufacturer’s standard accessory materials for deck that comply with requirements indicated.

B. Mechanical Fasteners: Self-drilling tapping screws that are in compliance with ASTM C1513 and that have been tested in accordance with AISI standards S904 and S905.

C. Miscellaneous Sheet Metal Deck Accessories: Steel sheet, minimum yield strength of same material and finish as deck; of profile indicated or required for application.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine supporting frame and field conditions for compliance with requirements for installation tolerances and other conditions affecting performance.
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. Install deck with corrugations running perpendicular to supports. Deck sheet shall be supported by a minimum of four supports (three span condition).

3.3 ROOF-DECK INSTALLATION

A. Miscellaneous Roof-Deck Accessories: Install roof sump pans, sump plates, ridge and valley plates, finish strips, end closures, and reinforcing channels according to deck manufacturer’s written instructions.

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

3.4 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 on both surfaces of prime-painted deck immediately after installation, and apply repair paint.

C. Provide final protection and maintain conditions to ensure that steel deck is without damage or deterioration at time of Substantial Completion.

END OF SECTION
SECTION 05 4000
COLD-FORMED 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. Description:
   1. This section includes exterior load-bearing wall framing, interior load-bearing wall framing, exterior non-load-bearing wall framing, floor joist framing, rafter framing, and ceiling joist framing.

B. Related Documents and Standards:
   1. All referenced standards and cited publications shall be those specifically denoted within the applicable building code noted in the General Notes of the Construction Drawings.
   2. All Cold-Formed Steel Framing work on this project shall confirm to the Construction Documents, applicable building code including referenced standards, and where required shall be designed in accord with AISI D100 "Cold Formed Steel Design Manual".

C. Related Sections:
   1. Division 05 Specifications – Steel Construction.

1.3 QUALITY ASSURANCE

A. Framing members shall be manufactured and supplied by one manufacturer and be of the type and size as indicated on Construction Drawings and/or Shop Drawings.

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, ductility, and metallic-coating thickness.


D. AISI Specifications and Standards: Comply with AISI S100 “North American Specification for the Design of Cold-Formed Steel Structural Members” and S200 “Standard for Cold-Formed Steel Framing – General Provisions.”
   1. Comply with AISI S212 “Standard for Cold-Formed Steel Framing – Header Design.”

E. Preinstallation Conference: Conduct conference at Project site.
1.4 SUBMITTALS

A. Product Data: For each type of cold-formed steel framing product and accessory indicated.

B. LEED Submittals:
   1. Coordinate with Division 01 specifications for all LEED submittal requirements.

C. Shop Drawings: Submit Shop Drawings showing fabrication and erection procedures. Shop Drawing (if indicated as a requirement by this specification) shall bear the seal of a registered design professional licensed in the state in which the project is located.
   1. Show locations, sizes, gauges, spacing and types of framing composites, details of connections and framing of windows, doors and punched openings.
   2. Indicate all prefabricated framing with individual panels shown for each condition. Indicate member properties, details of connections, all erection and permanent bracing required.
   3. Indicate supplemental strapping, bracing, splices, bridging, accessories, and details required for installation.
   4. Shop Drawings shall indicate sequence and method of erection details of all connection of cold-formed steel framing to other elements of the building structure.
   5. Indicate shop and field assembly details, including cut and connections.
   6. Indicate type and location of welds, bolts, and fastening devices.

D. Delegated-Design Submittal: For work indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by the registered design professional responsible for their preparation.

E. Welding certificates.

F. Structural design calculations: Indicate compliance with specified design criteria. Calculations shall bear the seal of a registered design professional licensed in the state in which the project is located.

1.5 DELIVERY, STORAGE, AND HANDLING

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

B. Store cold-formed steel framing, protect with a waterproof covering, and ventilate to avoid condensation.

1.6 PERFORMANCE REQUIREMENTS

A. Delegated Design: Employ qualified design professional, licensed in the state in which the project is located, to perform design and prepare signed and sealed Shop Drawings and Calculations for submittal. Comply with design intent, criteria, and requirements of the Construction Documents.

B. Structural Performance: Provide cold-formed steel framing capable of withstanding design loads within limits and under conditions indicated in the Construction Documents.
   1. Deflection Limits: Design framing systems to withstand design loads without deflections greater than the following:
a. Exterior Wall Framing: Horizontal deflection of L/600 for brick/stone veneer, L/360 for simulated stone walls or stucco finish and L/240 for EIFS or other flexible finishes.
b. Roof Rafter Framing: Vertical deflection of 1/240 of the span.

C. Cold-Formed Steel Framing, General: Design according to AISI S100
   1. It is acceptable to design specific elements per the recommendations of the design standards of AISI S210 through S214.
   2. Non-structural framing members shall comply w/ ASTM C645.
   3. Structural Framing members shall comply w/ ASTM 955.
   4. Design exterior non-load-bearing wall framing to accommodate horizontal deflection without regard for contribution of sheathing materials.

D. In addition to design loads all cold-formed members shall be sized for the connection requirements of the cladding and/or framing which attaches to them, including but not limited to sheathing, paneling, doors, windows, louvers, minor canopies, and sun shades.

E. Existing Conditions: Inspect structure for compliance with specified erection tolerances.

F. Design and coordinate installation and location of anchors and inserts with structural system to which cold-formed steel framing is attached.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering cold-formed steel framing that may be incorporated into the Work include, but are not limited to, the following:
   1. Clark Dietrich Building Systems
   2. MarinoWare
   3. Cemco Steel

2.2 MATERIALS

A. Recycled Content of Steel Products: Coordinate with Division 01 specifications for all LEED recycled content requirements.

B. Galvanized steel meeting ASTM A1003, Designation G60, minimum 20 gauge.

C. Minimum yield strength:
   1. 33,000psi for 33 mil and 43 mil.
   2. 50,000psi for 54 mil, 68 mil, and 97 mil.

2.3 EXTERIOR NON-LOAD-BEARING WALL FRAMING

A. Steel Studs: Manufacturer’s standard C-shaped steel studs, of web depths indicated, punched, with stiffened flanges, and as follows:
   1. Minimum Base-Metal Thickness: 0.0329 inch.
   2. Flange Width: 1.375 inch.
B. Steel Track: Manufacturer’s standard U-shaped steel track, of web depths indicated, unpunched, with straight flanges, and as follows:
   1. Minimum Base-Metal Thickness: Matching steel studs.

C. Steel Box or Back-to-Back Headers: Manufacturer’s standard C-shapes and tracks used to form header beams, of web depths indicated or as required by design, punched, with stiffened flanges.

D. 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.

E. Single Deflection Track: Manufacturer’s single, deep-leg, U-shaped steel track; unpunched, with unstiffened flanges, of web depth to contain studs while allowing free vertical movement, with flanges designed to support horizontal and lateral loads and transfer them to the primary structure.

F. 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.

2.4 ROOF-RAFTER FRAMING

A. Steel Rafters: Manufacturer’s standard C-shaped steel joists, unpunched and without splices.

2.5 CEILING JOIST FRAMING

A. Steel Ceiling Joists: Manufacturer’s standard C-shaped steel joists, unpunched and without splices.

2.6 FRAMING ACCESSORIES

A. 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, knee braces, and girts.
   9. Joist hangers and end closures.

2.7 ANCHORS, CLIPS, AND FASTENERS

A. Power-Actuated Anchors: Fastener system of type suitable for application indicated, fabricated from corrosion-resistant materials, with capability to sustain, without failure, a load equal to 4 times design load.
B. 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.

C. Welding Electrodes: Comply with AWS standards.

2.8 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 or screw fastening, as standard with fabricator. 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, with screw penetrating joined members by not less than three exposed screw threads.
   4. Fasten other materials to cold-formed steel framing by welding, bolting, or screw fastening, according to Shop Drawings and manufacturer's requirements.

B. 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 1/4 inch 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 in AISI S100 and S200 and other conditions affecting performance.
   1. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION, GENERAL

A. Cold-formed steel framing may be shop or field fabricated for installation, or it may be field assembled.

B. Install framing according to AISI S100 as well as ASTM C1007 for structural members and C754 for non-structural members and to manufacturer's written instructions unless more stringent requirements are indicated.

C. Install 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.
D. Install 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 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. Handling and lifting of prefabricated panels or assemblies shall be done in a manner as to not cause distortion or damage in any member, or damage to any connection.

H. Loads placed on panels or assemblies during erection shall not exceed design loads.

I. Do not bridge building expansion and control joints with cold-formed steel framing. Independently frame both sides of joints.

J. If required, install insulation, specified in Division 07, 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.

K. 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 1/4 inch from plan location. Cumulative error shall not exceed minimum fastening requirements of sheathing or other finishing materials.

3.3 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 or as required by design.
   1. Anchor Spacing: As required by design, but not to exceed 24 inches max, and within 3 inches of ends.

B. Squarely seat studs against top and bottom tracks with gap not exceeding of 1/4 inch between the end of wall framing member and the web of track. Fasten both flanges of studs to bottom track, unless otherwise indicated. Space studs as follows:
   1. Stud Spacing: As indicated or as required by design.

C. Set studs plumb, except as needed for diagonal bracing or required for non-plumb walls or warped surfaces and similar requirements.

D. Isolate non-load-bearing steel framing from building structure to prevent transfer of vertical loads while providing lateral support.
   1. Install single-leg deflection tracks and anchor to building structure, or
2. Connect vertical deflection clips to studs and anchor to building structure, or
3. In high seismic areas connect drift clips to cold formed steel framing and anchor to building structure.

E. Install horizontal bridging in stud system, spaced at 48 inches. Decrease spacing as required by design. Fasten at each stud intersection.
1. Top Bridging for Single Deflection Track: Install row of horizontal bridging within 12 inches of single deflection track, or install a combination of flat, taut, steel sheet straps of width and thickness indicated and stud or stud-track solid blocking of width and thickness matching studs. Fasten flat straps to stud flanges and secure solid blocking to stud webs or flanges.
   a. Install solid blocking at 96-inch centers.
2. Bridging: Cold-rolled steel channel, welded or mechanically fastened to webs of punched studs.
3. Bridging: Combination of flat, taut, steel sheet straps of width and thickness indicated and stud-track solid blocking of width and thickness to match studs. Fasten flat straps to stud flanges and secure solid blocking to stud webs or flanges.
4. Bridging: Proprietary bridging bars installed according to manufacturer’s written instructions.

F. Install miscellaneous framing and connections, including stud kickers, web stiffeners, clip angles, continuous angles, anchors, fasteners, and stud girts, to provide a complete and stable wall-framing system.

3.4 JOIST INSTALLATION

A. Install perimeter joist track sized to match joists. Align and securely anchor or fasten track to supporting structure at corners, ends, and spacing indicated on Shop Drawings.

B. Install joists bearing on supporting frame, level, straight, and plumb; adjust to final position, brace, and reinforce. Fasten joists to both flanges of joist track.
1. Install joists over supporting frame with required end bearing.
2. Reinforce ends and bearing points of joists with web stiffeners, end clips, joist hangers, steel clip angles, or steel-stud sections as indicated on Shop Drawings.

C. Space joists not more than 2 inches from abutting walls, and as follows:
1. Joist Spacing: as indicated or as required by design.

D. Frame openings with built-up joist headers consisting of joist and joist track, nesting joists, or another combination of connected joists if indicated.

E. Install joist reinforcement at interior supports with single, short length of joist section located directly over interior support, with lapped joists of equal length to joist reinforcement, or as indicated on Shop Drawings.
1. Install web stiffeners to transfer axial loads of walls above.

F. Install bridging at intervals as indicated or as required by design. Fasten bridging at each joist intersection as follows:
1. Bridging: Joist-track solid blocking of width and thickness indicated, secured to joist webs.
2. Bridging: Combination of flat, taut, steel sheet straps of width and thickness indicated and joist-track solid blocking of width and thickness indicated. Fasten flat straps to bottom flange of joists and secure solid blocking to joist webs.
G. Secure joists to load-bearing interior walls to prevent lateral movement of bottom flange.

H. Install miscellaneous joist framing and connections, including web stiffeners, closure pieces, clip angles, continuous angles, hold-down angles, anchors, and fasteners, to provide a complete and stable joist-framing assembly.

3.5 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
SECTION 05 4500

PRE-ENGINEERED COLD-FORMED STEEL TRUSSED FRAMES

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. Description:
   1. This section includes Pre-Engineered Cold-Formed Steel Trusses consisting of welded, screwed or bolted connected members which are fabricated, cut and assembled prior to delivery or at the job site. Work may be referred to on the Construction Documents as Pre-Engineered Cold-Formed Steel Trusses.
   2. Types of prefabricated trusses include:
      a. Gable-shaped trusses.
      b. Monopitch trusses.
      c. Irregular shaped trusses.

B. Related Documents and Standards:
   1. All referenced standards and cited publications shall be those specifically denoted within the applicable building code noted in the General Notes of the Construction Drawings.
   2. All Cold-Formed Steel Framing work on this project shall confirm to the Construction Documents, applicable building code including referenced standards, and where required shall be designed in accord with AISI “Cold Formed Steel Design Manual”.

C. Related Sections:
   1. Division 05 Specifications – Steel Construction.

1.3 QUALITY ASSURANCE

A. Framing members shall be manufactured and supplied by one manufacturer and be of the type and size as indicated on drawings and/or shop drawings.

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, ductility, and metallic-coating thickness.


D. AISI Specifications and Standards: Comply with AISI’s “North American Specification for the Design of Cold-Formed Steel Structural Members” and its “Standard for Cold-Formed Steel Framing – General Provisions.”
   1. Comply with AISI’s “Standard for Cold-Formed Steel Framing - Truss Design.”
E. Trusses shall be designed, fabricated, and erected by a firm which has a record including a minimum of five years of successfully fabricated trussed assemblies similar to scope required and which practices a quality control program which includes inspection by an independent inspection and testing agency acceptable to Architect and authorities having jurisdiction.

F. Preinstallation Conference: Conduct conference at Project site.

1.4 SUBMITTALS

A. Product Data: For each type of truss product and components and accessories indicated.

B. LEED Submittals:
   1. Coordinate with Division 01 specifications for all LEED submittal requirements.

C. Shop Drawings: Submit shop drawings showing fabrication and erection procedures. Shop drawings shall bear the seal of a registered design professional licensed in the state in which the project is located.
   1. Show locations, sizes, gage, and dimensions of members to be used including pitch, span, camber configuration and spacing for each type or configuration of truss required. Show all bearing and anchorage details. Specify and detail all supplemental strapping, bracing clips and other accessories required for proper installation. Shop drawings shall include all placement sequences and instructions.
   2. Shop drawings shall indicate sequence and method of erection details of all connection of trusses to other elements of the building structure.

D. Delegated-Design Submittal: For work indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by the registered design professional responsible for their preparation.

E. Welding certificates.

F. Fabricator’s Certificate of Compliance: For each approved fabricator that is exempt from Special Inspections of shop fabrications and implementation procedures in accordance with Section 1704.2.5.2 of the Building Code, the Contractor shall submit “Fabricator’s Certificate of Compliance.” Contractor shall also provide copies of fabricator’s certification or building code evaluation services report and fabricator’s quality control manual.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Handle and store truss materials and accessories in accordance with manufacturer’s instructions to avoid damage from bending, overturning or other cause for which truss is not designed to resist or endure. Storage shall be off-ground in a dry ventilated space or protect with waterproof coverings.

B. Time fabrication and erection of trusses to avoid extended on-site storage and to avoid delaying work of other trades whose work must follow erection of trusses.

1.6 PERFORMANCE REQUIREMENTS

A. Delegated Design: Employ qualified design professional, licensed in the state in which the project is located, to perform design and prepare signed and sealed Shop Drawings and
Calculations for submittal. Comply with design intent, criteria, and requirements of the Construction Documents.

B. Structural Performance: Provide trusses capable of withstanding design loads within limits and under conditions indicated in the Construction Documents.
   1. Deflection Limits: Design trusses to withstand design loads without deflections greater than the following:
      a. Roof Trusses: L/240 for Live Load, and L/180 for Total Load.

C. Cold-Formed Steel Framing, General: Design according to AISI’s “Standard for Cold-Formed Steel Framing – General Provisions.”
   1. Roof Trusses: Design according to AISI’s “Standard for Cold-Formed Steel Framing – Truss Design.

D. In addition to design loads all cold formed members shall be sized for the connection requirements of the sheathing and/or framing which attaches to them, including but not limited to sheathing, paneling, and suspended equipment.

E. Existing conditions: Inspect structure for compliance with specified erection tolerances.

F. Design and coordinate installation and location of anchors and inserts with structural system to which trusses are attached.

PART 2 - PRODUCTS

2.1 FRAMING COMPONENT MANUFACTURERS

A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering cold-formed steel framing components that may be incorporated into the Work include, but are not limited to, the following:
   1. All-Span, Inc
   2. Alpine TrusSteel
   3. Clark Dietrich Building Systems
   4. Cemco Steel
   5. Marino\Ware

2.2 MATERIALS

A. Recycled Content of Steel Products: Coordinate with Division 01 specifications for all LEED recycled content requirements.

B. Galvanized steel meeting ASTM A1003, designation G60, minimum 20 gauge, and minimum 16 gauge for members being welded to structure. Connector plates and connection anchors shall be G90 minimum.

2.3 ROOF TRUSSES

A. Roof Truss Members: Manufacturer’s standard-shape steel sections.
2.4 FRAMING ACCESSORIES

A. Provide accessories of manufacturer's standard thickness and configuration, unless otherwise indicated, as follows:
   1. Bracing, bridging, and solid blocking.
   2. Web stiffeners.
   3. Anchor clips.
   4. End clips.
   5. Gusset plates.

2.5 ANCHORS, CLIPS, AND FASTENERS

A. Power-Actuated Anchors: Fastener system of type suitable for application indicated, fabricated from corrosion-resistant materials, with capability to sustain, without failure, a load equal to 4 times design load.

B. 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.

C. Welding Electrodes: Comply with AWS standards.

2.6 FABRICATION

A. Fabricate trusses 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 truss assemblies using jigs or templates.
   2. Cut framing members by sawing or shearing; do not torch cut.
   3. Fasten truss component members by welding or screws.
      a. Comply with AWS D1.3 requirements and procedures for welding, appearance and quality of welds, and methods used in correcting welding work.
   4. Provide all angles, clips, and other miscellaneous pieces necessary to attach trusses to building structure or to attach accessories to trusses.

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

3.2 INSTALLATION, GENERAL

A. Pre-engineered cold-formed steel trussed frames shall be fabricated either on or off site prior to erection.
3.3 TRUSS INSTALLATION

A. Install, bridge, and brace trusses according to Shop Drawings and requirements in this Section.

B. Truss Spacing: as indicated or as required by design.

C. Do not alter, cut, or remove framing members or connections of trusses.

D. Erect trusses with plane of truss webs plumb and parallel to each other, align, and accurately position at spacing indicated.

E. Erect trusses without damaging framing members or connections.

F. Install continuous bridging and permanently brace trusses as indicated on Shop Drawings and designed according to LGSEA’s Technical Note 551e, "Design Guide for Permanent Bracing of Cold-Formed Steel Trusses."

3.4 REPAIRS AND PROTECTION

A. Galvanizing Repairs: Prepare and repair damaged galvanized coatings on fabricated and installed trusses 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
SECTION 06 1000
ROUGH CARPENTRY - ARCHITECTURAL

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Wood blocking and furring.

B. Related Sections:
   1. Division 01 - Administrative, procedural, and temporary work requirements.
   2. Section 06 4100 – Architectural Wood Casework
   3. Section 08 7100 – Door Hardware
   4. Section 09 2900 – Gypsum Board Assemblies
   5. Section 10 2813 – Toilet Accessories

1.2 REFERENCES

A. American Wood Protection Association (AWPA):
   1. M4 - Standard for the Care of Preservative Treated Wood Products.

B. ASTM International (ASTM):

C. Engineered Wood Association (APA) PRP-108 - Performance Standards and Qualification Policy for Structural-Use Panels.

D. Forest Stewardship Council (FSC) STD-40-004 - Chain of Custody Standard.


F. Northeastern Lumber Manufacturers Association (NELMA) - Standard Grading Rules for Northeastern Lumber.

G. National Lumber Grades Authority (NLGA) - Standard Grading Rules for Canadian Lumber.

H. Redwood Inspection Service (RIS) - Standard Specifications for Grades of California Redwood Lumber.

I. Southern Pine Inspection Bureau (SPIB) - Standard Grading Rules for Southern Pine Lumber.

J. West Coast Lumber Inspection Bureau (WCLIB) - Standard Grading Rules for West Coast Lumber.

K. Western Wood Products Association (WWPA) G-5 - Western Lumber Grading Rules.

1.3 SUBMITTALS

A. None required.
1.4 QUALITY ASSURANCE
   A. Lumber Grading Agency: Certified to NIST PS 20.
   B. Identify lumber and sheet products by official grade mark.
   C. Fire Retardant Treated Products: Bear label of recognized independent testing laboratory indicating flame spread rating of 25 or less, tested to ASTM E84.

1.5 DELIVERY, STORAGE AND HANDLING
   A. Store materials minimum 6 inches above ground on framework or blocking and cover with protective waterproof covering providing for adequate air circulation.
   B. Do not store seasoned or treated materials in damp location.
   C. Protect edges and corners of sheet materials from damage.

PART 2 - PRODUCTS

2.1 MATERIALS
   A. General:
      1. Dimensions: Indicated lumber and sheet materials dimensions are nominal. Actual dimensions conform to industry standards referenced in this section or PS-20-70 (Reaffirmed 1981).
      2. Framing lumber: Graded under ALSC rules adopted by SFPA or WWPA; S4S lumber, surfaced four sides, unless otherwise indicated.
      3. Structural lumber:
         a. SPIB graded: Use SPIB Empirical Design Values for Grade; NO.2 NonDense Grade, minimum.
         b. WWPA graded: Use WWPA In-Grade Base Values for Species and Grade times Size Factor; NO.2 Grade, minimum.
      4. Moisture content, lumber: KD19, except as otherwise indicated.
      5. Furnish materials for construction activities under this section suitable for intent and purpose specified. Any species meeting code requirements acceptable, unless otherwise specified below.
   B. Lumber:
      1. Light framing, 2 to 4 nominal thickness, 2 to 6 nominal wide:
         a. General framing: WWPA, STAND & BTR Grade; SPIB, STUD Grade.
         b. Plates, blocking, bracing, and nailers: WWPA, STAND & BTR Grade; SPIB, STUD Grade.
         c. General utility purposes: WWPA, STAND & BTR Grade; SPIB, STUD Grade.
         d. Lumber for fire retardant or preservative treatment: SPIB No.2 NonDense Grade, Southern Pine or WWPA No.2 Grade, minimum.
      2. Specific uses/grades not included above: Follow recommended grades for intended use defined in SPIB and WWPA standards in REFERENCES Article above.
      3. Fabricate to shapes required and indicated.
   C. Sheet materials:
      1. Plywood: Conform to types and thicknesses recommended for intended usage by APA standards in REFERENCES Article above.

2.2 ACCESSORIES
A. Fasteners:
   1. Type and size: As required by conditions of use.
   2. Exterior locations and treated products: Hot-dip galvanized steel, ASTM A153/A153M, G90 coating class
   3. Other interior locations: Plain steel.

2.3 FABRICATION

A. Preservative Treatment:
   1. Treat lumber and sheet products in accordance with AWPA U1:
      a. Interior locations protected from moisture sources: Category UC1 - Interior/Dry.
      b. Interior locations subject to sources of moisture: Category UC2 - Interior/Damp.
      c. Exterior locations above ground: Category C3A - Above Ground/Protected.
      UC3B - Above Ground/Exposed.
   2. Exterior locations in contact with ground: Category UC4A - Ground Contact/General Use.
   3. Treatment process: Type CCA - Chromated Copper Arsenate.

B. Fire Retardant Treatment; treat lumber and sheet products in accordance with AWPA U1:
   1. Interior locations: Category UCFA - Fire Retardant/Interior.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Provide blocking, nailers, grounds, furring, and other similar items required to receive and support work.

B. Set members level, plumb, and rigid.

C. Curb roof openings except where prefabricated curbs are provided. Form corners by alternating lapping side members.

D. Install telephone and electrical panel backboards where indicated. Oversize panel by 12 inches on all sides.

E. Treat field cuts and holes in members providing structural support in accordance with AWPA M4.

APPENDIX – SCHEDULE OF SUBMITTALS – NOT INCLUDED

END OF SECTION
SECTION 06 1000
ROUGH CARPENTRY - STRUCTURAL

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Description:
   1. This section includes framing with dimension lumber, framing with timber, framing with engineered wood products, wood blocking, and nailers.

B. Related Documents and Standards:
   1. All referenced standards and cited publications shall be those specifically denoted within the applicable building code noted in the General Notes of the Construction Drawings.
   2. All Rough Carpentry work on this project shall confirm to the Construction Documents and applicable building code including referenced standards.

C. Related Sections:
   1. Division 05 Specifications – Steel Construction.
   2. Division 09 Specification – Finishes

1.3 QUALITY ASSURANCE

A. Source Limitations for Engineered Wood Products: Obtain each type of engineered wood product through one source from a single manufacturer.

B. Grade Marks: Identify all lumber and plywood by official grade marks.
   1. Lumber: Grade stamp to contain symbol of grading agency, mill number or name, grade of lumber, species or species grouping or combination designation, rules under which graded, where applicable, and condition of seasoning at time of manufacture.
   2. Softwood Plywood: Appropriate grade trademark of the American Plywood Association indicating:
      a. Type, grade, class and identification index.
      b. Inspection and testing agency mark.

1.4 SUBMITTALS

A. Product Data: For each type of process and factory-fabricated product. Indicate component materials and dimensions and include construction and application details.
   1. Include data for wood-preservative treatment from chemical treatment manufacturer and certification by treating plant that treated materials comply with requirements. Indicate type of preservative used and net amount of preservative retained.
2. Include data for fire-retardant treatment from chemical treatment manufacturer and certification by treating plant that treated materials comply with requirements. Include physical properties of treated materials based on testing by a qualified independent testing agency.

3. For products receiving a waterborne treatment, include statement that moisture content of treated materials was reduced to levels specified before shipment to Project site.

4. Include copies of warranties from chemical treatment manufacturers for each type of treatment.

B. LEED Submittals:
   1. Coordinate with Division 01 specifications for all LEED submittal requirements.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Immediately upon delivery to the job site, place materials in areas protected from weather.

B. Stack lumber flat with spacers between each bundle to provide air circulation. Provide for air circulation around stacks and under coverings.

C. Store materials a minimum of 6” above ground on blocking and cover with protected waterproof covering, providing for adequate air circulation and ventilation.

D. Do not store seasoned materials in wet or damp portions of building.

PART 2 - PRODUCTS

2.1 WOOD PRODUCTS, GENERAL

A. Lumber: 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. For exposed lumber indicated to receive a stained or natural finish, omit grade stamp and provide certificates of grade compliance issued by grading agency.
   3. Provide dressed lumber, S4S, unless otherwise indicated.

B. Engineered Wood Products: Provide engineered wood products acceptable to authorities having jurisdiction and for which current model code research or evaluation reports exist that show compliance with building code in effect for Project.
   1. Allowable Design Stresses: Provide engineered wood products with allowable design stresses, as published by manufacturer, that meet or exceed those indicated. Manufacturer’s published values shall be determined from empirical data or by rational engineering analysis and demonstrated by comprehensive testing performed by a qualified independent testing agency.

2.2 WOOD-PRESERVATIVE-TREATED LUMBER

A. Preservative Treatment by Pressure Process: AWPA U1
   1. Preservative Chemicals: Acceptable to authorities having jurisdiction.
2. For exposed items indicated to receive a stained or natural finish, use chemical formulations that do not require incising, contain colorants, bleed through, or otherwise adversely affect finishes.

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.
   1. For exposed lumber indicated to receive a stained or natural finish, omit marking and provide certificates of treatment compliance issued by inspection agency.

D. Application: Treat items indicated on Construction Drawings.

2.3 FIRE-RETARDANT-TREATED MATERIALS

A. General: Comply with performance requirements in AWPA U1

B. Identify fire-retardant-treated wood with appropriate classification marking of testing and inspecting agency acceptable to authorities having jurisdiction.
   1. Where denoted on Construction Drawings, provide pigmented wood treatment for visual recognition of Fire-Retardant-Treated materials.
   2. For exposed lumber indicated to receive a stained or natural finish, omit marking and provide certificates of treatment compliance issued by inspection agency, or use chemical formulations that do not bleed through, contain colorants, or otherwise adversely affect finishes.

C. Application: Treat items indicated on Construction Drawings

2.4 DIMENSION LUMBER FRAMING

A. Dimensions: Indicated lumber dimensions are nominal. Actual dimensions conform to industry standards established by the American Lumber Standards Committee and all the rules writing agencies.

B. Maximum Moisture Content shall be as noted in the Construction Drawings.

C. Non-Load-Bearing Interior Partitions shall be of a grade, species, and modulus of elasticity noted in the Construction Drawings.

D. Exterior and Load-Bearing Walls shall be of a grade, species, and modulus of elasticity in the Construction Drawings.

E. Joists, Rafters, and Other Framing Not Listed Above shall be of a grade, species, and modulus of elasticity noted in the Construction Drawings.

F. Exposed Framing: Provide material hand-selected for uniformity of appearance and freedom from characteristics, on exposed surfaces and edges, that would impair finish appearance, including decay, honeycomb, knot-holes, shake, splits, torn grain, and wane.
   1. Species and Grade: As indicated above for load-bearing construction of same type.
2.5 TIMBER FRAMING

A. Timber framing shall be of a dimension, grade, species, and modulus of elasticity noted in the Construction Drawings.

2.6 MISCELLANEOUS LUMBER

A. General: Provide miscellaneous lumber indicated and lumber for support or attachment of other construction, including the following:
   1. Blocking.
   2. Nailers.

B. Dimensions: Indicated lumber dimensions are nominal. Actual dimensions conform to industry standards established by the American Lumber Standards Committee and all the rules writing agencies.

C. Maximum Moisture Content shall be as noted in the Construction Drawings.

D. Miscellaneous Lumber shall be of a grade, species, and modulus of elasticity noted in the Construction Drawings.

2.7 FASTENERS

A. General: Provide fasteners of size and type indicated in Construction Drawings that comply with requirements specified in this article for material and manufacture.

B. Nails, Brads, and Staples: ASTM F 1667.


D. Wood Screws: ASME B18.6.1.

E. Lag Bolts: ASME B18.2.1

F. Bolts: Steel bolts complying with ASTM A 307, Grade A; with ASTM A 563 hex nuts and, where indicated, flat washers.

G. Post-Installed Anchors: All expansion, screw, and adhesive anchors shall be as noted in the Construction Drawings.

2.8 METAL FRAMING ANCHORS

A. Manufacturers: Subject to compliance with requirements, provide products by the manufacturer(s) noted in the Construction Drawings.

B. Basis-of-Design Products: Subject to compliance with requirements, provide products indicated on Construction Drawings.
3.1 INSTALLATION, GENERAL

A. Set rough carpentry to required levels and lines, with members plumb, true to line, cut, and fitted. Fit rough carpentry to other construction; scribe and cope as needed for accurate fit. Locate nailers, blocking, and similar supports to comply with requirements for attaching other construction.

B. Framing Standard: Comply with AF&PA's "Details for Conventional Wood Frame Construction," unless otherwise indicated.

C. Framing with Engineered Wood Products: Install engineered wood products to comply with manufacturer's written instructions.

D. Metal Framing Anchors: Install metal framing anchors to comply with manufacturer's written instructions.

E. Do not splice structural members between supports, unless otherwise indicated.

F. Provide blocking and framing as indicated in Construction Drawings and as required to support facing materials, fixtures, specialty items, and trim.

G. 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.

H. Comply with AWPA M4 for applying field treatment to cut surfaces of preservative-treated lumber.

I. Securely attach rough carpentry work to substrate by anchoring and fastening as indicated in Construction Drawings, complying with the following:
   1. NES NER-272 for power-driven fasteners.
   2. Governing Model Code with relevant Addenda, referenced in Construction Drawings, and all related and referenced Standards.

J. Select fasteners of size that will not fully penetrate members where opposite side will be exposed to view or will receive finish materials. Make tight connections between members. Install fasteners without splitting wood; do not countersink nail heads, unless otherwise indicated.

K. For exposed work, arrange fasteners in straight rows parallel with edges of members, with fasteners evenly spaced, and with adjacent rows staggered.

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.

B. Attach items to substrates to support applied loading. Recess bolts and nuts flush with surfaces, unless otherwise indicated.
C. Where wood-preservative-treated lumber is installed adjacent to metal decking, install continuous flexible flashing separator between wood and metal decking.

3.3 JOIST AND RAFTER FRAMING INSTALLATION

A. General: Install floor joists with crown edge up and support ends of each member with not less than 1-1/2 inches of bearing on wood or metal, or 3 inches on masonry. Attach floor joists as noted in the Construction Drawings.

B. Do not notch in middle third of joists; limit notches to one-sixth depth of joist, one-third at ends. Do not bore holes larger than 1/3 depth of joist; do not locate closer than 2 inches from top or bottom.

C. Lap members framing from opposite sides of beams, girders, or partitions not less than 4 inches or securely tie opposing members together by toe nailing or metal connectors. Provide solid blocking of 2-inch nominal thickness by depth of joist over supports.

D. Provide solid blocking between joists under jamb studs for openings.

E. Provide bridging at intervals of 96 inches o.c., between joists.

F. Rafters: Notch to fit exterior wall plates and toe nail or use metal framing anchors. Double rafters to form headers and trimmers at openings in roof framing, if any, and support with metal hangers. Where rafters abut at ridge, place directly opposite each other and nail to ridge member or use metal ridge hangers.
   1. At valleys, bevel ends of jack rafters for full bearing against valley rafters. Where not specifically noted otherwise in Construction Drawings, provide double-valley rafters of size indicated or, if not indicated, of same thickness as regular rafters and 2 inches deeper.
   2. At hips, bevel ends of jack rafters for full bearing against hip rafter. Where not specifically noted otherwise in Construction Drawings, provide hip rafter of size indicated or, if not indicated, of same thickness as regular rafters and 2 inches deeper.

3.4 TIMBER FRAMING INSTALLATION

A. Install timber with crown edge up and provide not less than 4 inches of bearing on supports. Provide continuous members, unless otherwise indicated; tie together over supports as indicated if not continuous.

B. Install wood posts using metal anchors indicated.

C. Treat ends of timber beams and posts exposed to weather by dipping in water-repellent preservative for 15 minutes.

END OF SECTION
SECTION 06 1360
HEAVY TIMBER TRUSS CONSTRUCTION

PART 1 – GENERAL

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

1.2 SUMMARY:
   A. This Section includes truss framing using heavy timbers.
   B. Related Sections include the following:
      1. Section 06100 “Rough Carpentry” for dimension lumber items associated with heavy timber construction.

1.3 DEFINITIONS:
   A. Timbers: Lumber of 4 inches nominal or greater in least dimension.
   B. Inspection agencies, and the abbreviations used to reference them, include the following:
      2. NHLA – National Hardwood Lumber Association.
      3. NLGA – National Lumber Grades Authority.
      4. SPIB – Southern Pine Inspection Bureau.
      5. WCLIB – West Coast Lumber Inspection Bureau.
      6. WWPA – Western Wood Products Association.

1.4 PERFORMANCE REQUIREMENTS:
   A. Structural Performance: Provide heavy timber construction, including connectors, capable of withstanding structural loads shown on Drawings without exceeding the allowable design working stresses according to AITC’s “Timber Construction Manuel”.
      1. Design Loads: As indicated on Construction Drawings.
      2. Maximum Deflection Under Design Loads:
         a. Roof Trusses: As indicated.

1.5 SUBMITTALS:
   A. Product Data: For timber and timber connectors.
      1. Include data for wood-preservative treatment from chemical treatment manufacturer and certification by treating plant that treated materials comply with requirements. Indicate type of preservative used, net amount of preservative retained, and chemical treatment manufacturer’s written instructions for handling, storing, installing, and finishing treated material.
      2. For products receiving a waterborne treatment, include statement that moisture content of treated materials was reduced to levels specified before shipment to Project site.
      3. Include installation instructions for timber connectors.
B. Show Drawings: Show layout of heavy timber construction system, full dimensions of each member, and details of connections.

C. Samples: Full width and depth, 24 inches long, showing the range of variation to be expected in appearance, including surface texture, of wood products.

D. Material Certificates: For heavy timber construction specified to comply with minimum allowable unit stresses. Indicate species and grade selected for each use and design values approved by the American Lumber Standards Committee Board of Review.

E. Certificates of Inspection: Issued by lumber grading agency for exposed timber not marked with grade stamp.

F. Certificates of Chain-of-Custody: Signed by mill certifying that timber was obtained from forests certified by a Forest Stewardship Council-accredited certification body to be in compliance with the Forest Stewardship Council’s FSC 1.2 “Principles and Criteria”. Include evidence that mill is certified for chain-of-custody by a Forest Stewardship Council-accredited certification body.

1.6 QUALITY ASSURANCE:


B. Forest Certification: Provide timber obtained from forests certified by a Forest Stewardship Council-accredited certification body to be in compliance with the Forest Stewardship Council’s FSC 1.2 “Principles and Criteria”.

1.7 PROTECTION, DELIVERY, STORAGE, AND HANDLING:

A. Protect timber and components and keep under cover in transit. Schedule delivery of heavy timber construction to avoid extended on-site storage and to avoid delaying the work.

B. Store materials under cover and protected from weather and contact with damp or wet surfaces. Provide for air circulation within and around stacks and under temporary coverings.

C. Timbers or components damaged in shipment or at the jobsite shall be repaired or replaced at no cost to the Owner.

PART 2 – PRODUCTS

2.1 HEAVY TIMBER, GENERAL:

A. General: Comply with DOC PS 20 and grading rules of lumber grading agencies certified by American Lumber Standards Committee Board of Review, as applicable.

1. Factory mark each item of timber with grade stamp of grading agency.

2. For exposed timber indicated to receive a stained or natural finish, apply grade stamps to surfaces that will not be exposed to view or omit grade stamps and provide certificates of grade compliance issued by grading agency.

2.2 TIMBER:

A. Timber Species and Grade: Southern Yellow Pine, No. 1.
B. Moisture Content: Provide timber with 19 percent maximum moisture content at time of dressing.

C. Dressing: The Contractor is responsible for verifying and matching the dressing on the existing heavy timber trusses. The sample mentioned above shall be of the proposed dressing for verification by the Architect.

D. End Sealer: Manufacturer’s standard, transparent, colorless wood sealer that is effective in retarding the transmission of moisture at cross-grain cuts and is compatible with indicated finish.
   1. Use sealer that meets or exceeds VOC and chemical component limits of Green Seal requirements.

E. Penetrating Sealer: Manufacturer’s standard, transparent, penetrating wood sealer that is compatible with indicated finish.
   1. Use sealer that meets or exceeds VOC and chemical component limits of Green Seal requirements.

2.3 TIMBER CONNECTORS:

A. General: Unless otherwise indicated, fabricate from the following materials:
   1. Structural-steel shapes, plates, and flat bars complying with ASTM A 36/A 36M.
   2. Round steel bars complying with ASTM A 575, Grade M 1020.
   3. Hot-rolled steel sheet complying with ASTM A 1011, Structural Steel, Type SS, Grade 33.

B. Fabricate beam seats from steel with 3/8-inch bearing plates long deformed bar anchors, and 1/4" side plates.

C. Fabricate tie rods from round steel bars with upset threads connected with forged-steel turnbuckles complying with ASTM A 668/A 668M.

D. Provide bolts, 3/4 inch, unless otherwise indicated, complying with ASTM A 307, Grade A; nuts complying with ASTM A 563; and, where indicated, flat washers.

E. Finish steel assemblies and fasteners with rust-inhibitive primer, 2-mil dry film thickness.

2.4 FABRICATION:

A. Shop fabricate members by cutting and restoring exposed surfaces to match specified surfacing. Predrill for fasteners and assembly of units.
   1. Finish exposed surfaces to remove planning or surfacing marks and to provide a finish equivalent to that produced by machine sanding with No. 120 grit sandpaper.
   2. Where preservative treated members are indicated, fabricate (cutting, drilling, surfacing, and sanding) before treatment to the greatest extent possible. Where fabrication must be done after treatment, apply a field-treatment preservative to comply with AWPA M4.
      a. Use inorganic boron treatment for members not in contact with the ground and continuously protected from liquid water.

B. Seal Coat: After fabricating and surfacing each unit, apply a saturation coat of penetrating sealer on surfaces of each unit except for treated wood where the treatment included a water repellent. Seal coat shall be compatible with indicated finish.
PART 3 – EXECUTION

3.1 INSTALLATION:

A. Install wood trusses only after supporting construction is in place and is braced and secured.

B. If trusses are delivered to Project site in more than one piece, assemble trusses before installing.

C. Fit members by cutting and restoring exposed surfaces to match specified surfacing. Predrill for fasteners and assembly of units.

D. Cutting: Avoid extra cutting after fabrication. Where field fitting is unavoidable; comply with requirements for shop fabrication.
   1. Finish exposed surfaces to remove planning or surfacing marks and to provide a finish equivalent to that produced by machine sanding with No. 120 grit sandpaper.
   2. Coat crosscuts with end sealer.
   3. Where preservative-treated members must be cut during erection, apply a field-treatment preservative to comply with AWPA M4.
      a. Use inorganic boron treatment for members not in contact with the ground and continuously protected from liquid water.
      b. Use copper naphthenate treatment for members in contact with the ground or not continuously protected from liquid water.

E. Install timber connectors as indicated.
   1. Unless otherwise indicated, install bolts with same orientation within each connection and in similar connections.
   2. Install bolts with orientation as indicated or, if not indicated, as directed by Architect.

F. Hoist trusses in place by lifting equipment suited to sizes and types of trusses required, exercising care not to damage truss members or joints by out-of-plane bending or other causes.

G. Install and brace trusses according to SBCA/TPI recommendations and as indicated.

H. Install trusses plumb, square, and true to line and securely fasten to supporting construction.

I. Space trusses as indicated in Shop Drawings, per requirements indicated in Construction Drawings, and no further than indicated on plan. Adjust and align trusses in location before permanently fastening.

J. Anchor trusses securely at bearing points; use metal truss tie-downs or floor truss hangers as indicated in Construction Drawings. Install fasteners through each fastener hole in truss accessories according to manufacturer's fastening schedules and written instructions.

K. Securely connect each truss ply required for forming built-up girder trusses.

L. Anchor trusses to girder trusses as indicated in Construction Drawings.
M. Install and fasten permanent bracing during truss erection and before construction loads are applied. Anchor ends of permanent bracing where terminating at walls or beams.

N. Install bracing to comply with SBCA/TPI BCSI requirements.

O. Install wood trusses within installation tolerances in TPI 1.

P. Do not cut or remove truss members.

Q. Restrict construction loads on roof and floor surfaces to prevent over-stressing of truss members.

R. Replace wood trusses that are damaged or do not meet requirements.

S. Do not alter trusses in field.

3.2 ADJUSTING AND CLEANING:

A. Repair damaged surfaces and finishes after completing erection. Replace damaged heavy timber construction if repairs are not approved by Architect.

END OF SECTION
PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Solid-sawn wood roof decking.

B. Related Sections:
   1. Division 06 Section "Rough Carpentry" for dimension lumber items associated with wood decking.
   2. Division 06 Section "Exterior Rough Carpentry" for wood decking for elevated decks.
   3. Division 09 Section "Staining and Transparent Finishing".

1.2 REFERENCES

A. ASTM International (ASTM):
   1. ASTM D 2559
   2. ASTM F 1667
   3. ASTM F 1667
   4. ASTM A 307
   5. ASTM A 563/A 563M
   6. ASTM F 593
   7. ASTM F 738M
   8. ASTM F 594
   9. ASTM F 836M

B. AITC 112

C. FSC STD-01-001

D. DOC PS 20 ALSC's Board of Review

E. AWPA
   1. AWPA C31
   2. AWPA C28
   3. AWPA M4

F. VOC content

G. 40 CFR 59, Subpart D (EPA Method 24)

H. LEED
   1. Credit MR 7
   2. Credit EQ 4.1
   3. Credit EQ 4.4

1.3 SUBMITTALS

A. Product Data: For each type of product indicated.
   1. For glued-laminated wood decking, include installation instructions and data on lumber, adhesives, and fabrication.
   2. For preservative-treated wood products, include chemical treatment manufacturer's written instructions for handling, storing, installing, and finishing treated material.
B. LEED Submittals:

1. Certificates for Credit MR 7: Chain-of-custody certificates certifying that wood used for decking complies with forest certification requirements. Include evidence that manufacturer is certified for chain of custody by an FSC-accredited certification body.
   a. Include statement indicating costs for each certified wood product.

2. Product Data for Credit EQ 4.1: For sealants, including printed statement of VOC content.

3. Product Data for Credit EQ 4.4: For laminating adhesive used for glued-laminated decking, indicating that product contains no urea formaldehyde.

C. Samples: 24 inches (600 mm) long, showing the range of variation to be expected in appearance of wood decking.

1.4 QUALITY ASSURANCE


B. Forest Certification: Provide wood decking produced from wood obtained from forests certified by an FSC-accredited certification body to comply with FSC STD-01-001, “FSC Principles and Criteria for Forest Stewardship.”

1.5 DELIVERY, STORAGE AND HANDLING

A. Schedule delivery of wood decking to avoid extended on-site storage and to avoid delaying the Work.

B. Store materials under cover and protected from weather and contact with damp or wet surfaces. Provide for air circulation within and around stacks and under temporary coverings. Stack wood decking with surfaces that are to be exposed in the final Work protected from exposure to sunlight.

PART 2 - PRODUCTS

2.1 WOOD DECKING, GENERAL

A. General: Comply with DOC PS 20 and with applicable grading rules of inspection agencies certified by ALSC’s Board of Review.

B. Moisture Content: Provide wood decking with 15 percent maximum moisture content at time of dressing.

2.2 SOLID-SAWN WOOD DECKING

A. Decking Species: Southern Pine (SP) according to SPIB grading rules..

B. Decking Nominal Size: 2x6 or 2x8.

C. Decking Grade: Select Decking.

D. Grade Stamps: Factory mark each item with grade stamp of grading agency. Apply grade stamp to surfaces that will not be exposed to view.

E. Face Surface: As indicated.
F. Edge Pattern: As indicated.

G. Preservative Treatment: Pressure treat solid-sawn wood decking only where indicated according to AWPA C31 with inorganic boron (SBX) and re-dry wood to 15 percent maximum moisture content.

2.3 ACCESSORY MATERIALS

A. Fasteners for Solid-Sawn Decking: Provide fastener size and type complying with decking standard for thickness of deck used and as indicated in the drawings.

B. Nails: Common; complying with ASTM F 1667, Type I, Style 10.

C. Spikes: Round; complying with ASTM F 1667, Type III, Style 3.

D. Fastener Material: Hot-dip galvanized steel.

E. Bolts for Anchoring Decking to Walls: Carbon steel; complying with ASTM A 307 (ASTM F 568M) with ASTM A 563/A 563M hex nuts and, where indicated, flat washers, all hot-dip zinc coated.

F. Sealant: Latex sealant compatible with substrates or Elastomeric joint sealant complying with requirements in Division 07 Section "Joint Sealants" for Use NT (nontraffic) and for Uses M, G, A, and, as applicable to joint substrates indicated, O joint substrates.

   1. Use sealant that has a VOC content of 250 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

G. Penetrating Sealer: Clear sanding sealer complying with Division 09 Section "Staining and Transparent Finishing" and compatible with topcoats specified for use over it.

2.4 FABRICATION

A. Shop Fabrication: Where preservative-treated decking is indicated, complete cutting, trimming, surfacing, and sanding before treating.

B. Predrill decking for lateral spiking to adjacent units to comply with referenced decking standard.

C. Seal Coat: After fabricating and surfacing decking, apply a saturation coat of penetrating sealer in fabrication shop.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine walls and support framing in areas to receive wood decking for compliance with installation tolerances and other conditions affecting performance of wood decking.

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

3.2 INSTALLATION

A. Install solid-sawn wood decking to comply with referenced decking standard.

   1. Locate end joints lay-up indicated.
B. Anchor wood roof decking, where supported on walls, with bolts as indicated.

C. Where preservative-treated decking must be cut during erection, apply a field-treatment preservative to comply with AWPA M4.
   1. For solid-sawn decking, use inorganic boron (SBX).

D. Apply joint sealant to seal roof decking at exterior walls at the following locations:
   1. Between decking and supports located at exterior walls.
   2. Between decking and exterior walls that butt against underside of decking.
   3. Between tongues and grooves of decking over exterior walls and supports at exterior walls.

3.3 ADJUSTING
   A. Repair damaged surfaces and finishes after completing erection. Replace damaged decking if repairs are not approved by Architect.

3.4 PROTECTION
   A. Provide temporary waterproof covering as the Work progresses to protect roof decking until roofing is applied.

END OF SECTION
PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Exterior gypsum wall sheathing.

B. Related Sections:
   1. Division 01 - Administrative, procedural, and temporary work requirements.
   2. Section 05 4000 – Cold-Formed Metal Framing
   3. Section 07 2800 – Moisture Barriers

1.2 REFERENCES

A. ASTM International (ASTM):
   2. C1002 - Standard Specification for Steel Drill Screws for the Application of Gypsum
      Board.
      Sheathing.
      Interior Coatings in an Environmental Chamber.

1.3 SUBMITTALS

A. Product data: Submit manufacturer's specifications, installation instructions, and general
   recommendations for each major product required. Include data substantiating that products
   to be furnished comply with requirements of the contract documents. Mark manufacturer's
   brochures to include only those products proposed for use.

1.4 DELIVERY, STORAGE AND PROTECTION

A. Keep materials dry at all times.

B. Protect materials against exposure to weather and against contact with damp or wet
   surfaces.

C. Protect materials from excessive moisture in shipment, storage, and handling.

D. Deliver materials in manufacturer's unopened packages, and store in dry place with adequate
   air circulation.

E. Stack products of this section carefully to provide air circulation within stacks.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Acceptable Manufacturers:
   1. GP Gypsum Corporation. (www.gp.com)
   3. BPB America Inc.; GlasRoc: (www.bpb-na.com)
B. Substitutions: Under provisions of Division 01.

2.2 GYPSUM BOARD SHEATHING

A. Exterior Sheathing:
   1. Type: ASTM C1177/C1177M; 48 inches wide x 5/8 inch thick, maximum practical length, square cut ends and edges.
   3. Core: Water-resistant silicone-treated gypsum core.
   4. Facers: Alkali-resistant fiberglass mat front and back.
   5. Surface burning hazard (ASTM E 84): 0 flame spread, 0 smoke developed.
   6. Noncombustible when tested in accordance with ASTM E 136.

2.3 FASTENERS

A. Screws: ASTM C 1002; self-drilling type, cadmium-plated.

B. Fasteners for attaching gypsum board sheathing to metal framing:
   1. 12 to 22 gage steel framing: Type S-12 fine thread, rust resistant, drill point drywall screws.
   2. Over light gage metal framing or furring: Type S fine thread, rust resistant, sharp point drywall screws.
   3. Length: 1-1/4 inch (32 mm) minimum #6 for 5/8 inch (16 mm) thick sheathing.
   4. Length: 1 inch (25 mm) minimum #6 for 1/2 inch (13 mm) thick sheathing.

2.4 ACESSORIES

   1. Backer rod: Closed cell foam complying with the requirements of the joint sealer manufacturer.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Inspect substrates and conditions under which the work of this section will be performed, and verify that installation properly may commence. Do not proceed with the work until unsatisfactory conditions have been resolved fully.

3.2 SHEATHING INSTALLATION

A. Comply with manufacturer’s instructions, except where more stringent requirements are shown or specified, and except where project conditions require extra precautions or provisions to ensure satisfactory performance of the work.

B. Install sheathing over framing. Butt joints together. Layout work and use appropriate length material to avoid end joints. Joints shall occur over framing members. Stagger end joints between adjacent panels.

C. Fit sheathing snugly around windows, doors, and other openings.

D. Drive fasteners tight against and flush with sheathing surface. Do not countersink fasteners.

E. Locate fasteners not closer than 3/8 inch (10 mm) from edge and ends of panels.

F. Space fasteners at not more than 8 inches (203 mm) on center at perimeter and field, unless closer spacing is indicated on the drawings.
G. Moisture Protection: Treat cut edges and holes in sheathing with sealant.

H. Schedule installation of sheathing and of subsequent cladding to avoid exposure of sheathing beyond manufacturer's allowable limits.

I. Replace sheathing that is damaged, fails to meet with reference standard properties for new sheathing at the time permanent cladding is installed, or is otherwise unsuitable.

3.3 JOINT TREATMENT

A. Gypsum Board Sheathing:
   1. Treat joints and openings in wall sheathing using the methods listed. Rigid joint compound will not be acceptable for wall joints.
   2. Treat joints as soon as practicable after installation of sheathing. Joint treatment is intended to provide both short-term barrier protection of sheathing and building interior against wind and water infiltration before permanent cladding is installed, as well as long-term protection of sheathing and building interior against wind and water infiltration after project completion.
   3. Seal panel joints and adjacent construction to form a continuous, watertight and airtight barrier.
   4. Schedule installation of sheathing and of subsequent cladding to avoid exposure of sheathing beyond manufacturer's allowable limits.
   5. Replace sheathing that is damaged, fails to meet with reference standard properties for new sheathing at the time permanent cladding is installed, or is otherwise unsuitable.
   6. Joints between panels and adjacent construction, and at the interface of sheathing with doors, windows, and similar construction: Apply primer and install self-adhesive sheet joint seam tape. Ensure adhesion by pressing firmly with a roller; at locations inaccessible to roller tool, press firmly by hand.
   7. Joints between adjacent panels: Apply bead of sealant.
   8. Fasteners:
      a. Apply 3/8 inch (10 mm) diameter bead of sealant at fasteners.
      b. Use putty knife to smooth joints and cover fasteners.
   9. Sealant:
      a. Where joints are over 1/8 inch (3 mm) wide, install sealant over backer rod.
      b. Allow sealant to cure fully before concealing with subsequent construction.

3.4 FIELD QUALITY CONTROL

A. Inspect completed installation and notify the Architect in writing.

B. Do not conceal sheathing without approval.

3.5 CLEANING

A. During progress of the work, remove from project site all discarded materials, rubbish, and debris resulting from the work.

B. Upon completion, clean all surfaces which have become soiled or coated as a result of work of this section, using proper methods which will not scratch or otherwise damage finished surfaces.
   1. For cleaning, use only products and techniques acceptable to manufacturer of products being cleaned.

3.6 PROTECTION

A. Where sheathing barrier is damaged before installation of permanent cladding, repair in
accordance with manufacturer’s recommendations and to the satisfaction of the Architect.

APPENDIX – SCHEDULE OF SUBMITTALS

<table>
<thead>
<tr>
<th>Submittal Number</th>
<th>Item Number</th>
<th>Description</th>
<th>Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td>06 1643</td>
<td>061643-1.3-A-01</td>
<td>Product Data – Exterior Sheathing</td>
<td></td>
</tr>
<tr>
<td></td>
<td>06 1643</td>
<td>Gypsum Sheathing</td>
<td></td>
</tr>
</tbody>
</table>

END OF SECTION
SECTION 06 4100
ARCHITECTURAL WOOD CASEWORK

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Substrates for solid surfacing countertops
   2. Plastic laminate casework

B. Related Sections:
   1. Division 01 - Administrative, procedural, and temporary work requirements.
   2. Section 06 1000 – Rough Carpentry
   3. Section 06 6116 – Solid Surfacing Fabrications
   4. Section 09 9000 – Painting

1.2 REFERENCES

A. Applicable standards; comply with the following:
   1. Standards of the following, as referenced herein:
      b. APA The Engineered Wood Association (APA).
      c. ASTM International (ASTM).
      d. American Wood Protection Association (AWPA).
      e. Forest Stewardship Council (FSC).
      f. Hardwood Plywood and Veneer Association (HPVA).
      g. National Electric Manufacturers Association (NEMA).
      i. Underwriters Laboratories, Inc., (UL).
   2. Wood products; standards of the U. S. Department of Commerce, National Institute of Standards and Testing:

1.3 SUBMITTALS

A. Shop drawings: Submit for architectural woodwork. Indicate construction and installation details, species and grades of materials, finishes, plastic laminate and cabinet hardware selections. Indicate joint locations that will be visible in finished work.

B. Product data: Submit for cabinet hardware and similar manufactured items. Submit with shop drawings. Mark manufacturer's brochures to include only those products proposed for use.

C. Samples; submit as follows:
   2. Hardware items: Submit if requested by Architect. Samples will be returned to supplier.

D. Fire-retardant treatment certification: Submit for Architect's information only. Submit certification by treating plant that fire retardant treatment materials comply with governing ordinances and that treatment will not bleed through finished surfaces.
E. Sustainability submittals:
   1. For composite wood products and adhesives, documentation indicating that product contains no urea formaldehyde.

1.4 QUALITY ASSURANCE

A. Grade marks: Identify lumber and plywood by official grade mark.
   1. Lumber: Grade stamp shall contain symbol of grading agency, mill number or name, grade of lumber, species or species grouping or combination designation, rules under which graded where applicable, and condition of seasoning at time of manufacture.
   2. Plywood: Appropriate grade trademark of the APA. Indicate type, grade, class, identification index and inspection and testing agency mark.
   3. On components to be exposed to view, grade marks shall be located so as to be concealed in finished work.

B. Fabricator/installer qualifications:
   1. Architectural woodwork shall be fabricated and installed by a single manufacturer.
   2. Fabricator/installer shall have at least five years successful experience in the fabrication, finishing and installation of architectural woodwork of the type and quantity required and, if requested by Architect, shall submit evidence of such experience.

C. Job mock-up:
   1. Erect a full size mock-up of cabinet work at project site for Architect's acceptance. If unacceptable, erect additional mock-ups until acceptable.
   2. Mock-up shall indicate the following:
      a. Workmanship.
      b. Finishes.
      c. Relationships to adjacent work.
      d. Do not begin woodwork production until each mock-up has been accepted by Architect.
   3. Accepted, undamaged mock-ups may remain as part of the finished work.

D. Pre-installation conference:
   1. Prior to beginning work, a pre-installation conference will be held to review work to be accomplished.
   2. Contractor, fabricator/installer and Architect shall be present.
   3. Contractor's submittals will be reviewed.
   4. Substrates and conditions under which woodwork shall be installed will be reviewed.
   5. Contractor shall notify all parties at least seven days prior to time of conference.
   6. Contractor shall record minutes of meeting and distribute to all parties in attendance.

1.5 DELIVERY, STORAGE AND HANDLING

A. Deliver no woodwork to project site until areas are ready for woodwork installation.

B. Immediately upon delivery to job site, place woodwork indoors, protected from weather.

C. Store woodwork a minimum of 6" above floor on blocking and cover with waterproof covering. Provide for air circulation and ventilation. Store in dry, conditioned space.

D. Wrap prefinished woodwork in black polyethylene for shipping and storage. Protect from sunlight exposure.

1.6 PROJECT CONDITIONS

A. Field measurements: Take field measurements to ascertain exact woodwork sizes. Indicate
exact dimensions on shop drawings.

B. Install no interior woodwork until spaces are enclosed, dry and conditioned. Maintain temperature between 55 degrees F. and 80 degrees F. for 72 hours before beginning installation and afterwards until Date of Substantial Completion.

C. Maintain interior relative humidity at the site between 25% and 55% before, during, and after installation.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Lumber for opaque finish:
   1. Species: Poplar.
   2. Lumber grade: II.
   3. Moisture content: 8-13%.
   4. Locations: As indicated on drawings.

B. Wood Products: Comply with the following:
   1. Low-emitting materials: Composite wood products shall comply with the testing and product requirements of the California Department of Health Services’ “Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers.”
      a. Hardboard: AHA A135.4. 1/4” thickness.
      b. Medium-density fiberboard: Meeting ANSI A208.2; Grade MD; Class "C" fire hazard classification for 3/4” thickness, made with binder containing no urea formaldehyde.
      c. Plywood:
         1) Veneer-faced panel products (Hardwood plywood): HPVA HP-1, made with adhesive containing no urea formaldehyde.
         2) Softwood plywood: DOC PS 1, Medium Density Overlay.

C. Plastic laminates:
   1. Acceptable products:
      b. Formica Corp., Formica.
      c. Panolam Industries, Nevamar.
      d. Or equal.
   2. Conforming to NEMA Standard LD3-2005, as follows:
      a. Horizontal applications: Grade HGL.
      b. Vertical applications: Grade VGS.
      c. Cabinet-liner: Grade CL-20.
      d. Backing sheet: Grade BKL, undecorated plastic laminate.
      e. Post-forming applications: Grade HGP.
      f. Chemical resistant applications: Grade VGP.
      g. Solid color applications: Grade HGS.
   3. Colors, textures and patterns: Selected from manufacturer’s full range.

2.2 ARCHITECTURAL CABINETS

A. Architectural cabinets shall comply with AWI Standards, Section 400.

B. Plastic laminate clad cabinets:
   1. AWI quality grade: Custom.
   2. Panel core:
b. Doors: Medium-density fiberboard.
3. Finish on exposed surfaces: Plastic laminate as specified herein.

C. Tops:
1. Plastic laminate:
   a. AWI quality grade; Custom.
   c. Core: Medium density fiberboard.
2. Solid surfacing top: As specified in Solid Surfacing Fabrication section.

2.3 HARDWARE

A. Door and drawer pulls:
1. Acceptable products:
   b. Sugatsune America, Inc., #SST-30M.
   c. Stanley Works #4484, 4" long.
   d. Or equal.
2. Type: 4" long wire pull, US26D finish.

B. Magnetic catches:
1. Acceptable manufacturers:
   a. Basis of design: Stanley Works #SP41.
   b. Epco, Inc.
   c. Sugatsune America, Inc.
   d. Or equal.

C. Concealed hinges:
1. Acceptable products:
   a. Grass America, Inc., #3903.
   b. Julius Blum, Inc., #71.6500 Series.
   c. Sugatsune America, Inc., #H160-C.
   d. Or equal.
2. Type: 165 degree opening, self-closing.

D. Shelf standards and supports:
1. Acceptable manufacturers:
   b. Capitol Hardware, Inc.
   c. Gacy Corp.
   d. Stanley Works.
   e. Johnson Hardware, Inc.
   f. Or equal.
2. Type: Steel.

E. Side mount drawer slides:
1. Acceptable products:
   a. Basis of design: Accuride, #3832.
   b. Grant Hardware Co., #5632.
   d. Or equal.
2. Type: Full extension, steel ball bearing.
3. Capacity: 100 lb. capacity.

F. Cabinet drawer/door lock:
   1. Acceptable products:
      b. Sugatsune America, Inc., #3310.
      c. Timberline Supply, Ltd., Style CB-230 deadlock and Type 230 cylinder body with lock plug.
      d. Or equal.

G. Wire management grommet:
   1. Acceptable products:
      a. Outwater Plastics, Inc., #31-2".
      b. Sugatsune America, Inc., #V60-B.
      d. Or equal.

H. Fasteners: Provide bolts, nails, screws, toggle bolts and similar fasteners as indicated or required to attach and secure work.
   1. Fasteners for trim shall be finishing nails for attachment to wood framing, trim-head screws for attachment to metal framing.
   2. Material and finish fasteners in contact with non-pressure treated components shall be G90 hot dip galvanized steel or Type 304 stainless steel, except nails shall be hot dip galvanized.
   3. Material and finish for fasteners in contact with pressure-treated components shall be G185 hot-dip galvanized steel or Type 316L stainless steel.

2.4 ADHESIVES

A. Adhesives shall not contain urea formaldehyde.

B. VOC limits for installation adhesives: Installation adhesives shall comply with the following limits for VOC content when calculated according to 40 CFR 59, Subpart D (EPA Method 24):
   1. Wood Glues: 30 g/L.
   2. Multipurpose Construction Adhesives: 70 g/L.
   3. Contact Adhesive: 250 g/L.
   4. Adhesive for bonding plastic laminate: Acceptable types include unpigmented contact cement, contact cement, PVA, urea formaldehyde and resorcinol.
   5. Adhesive for bonding edges: Hot-melt adhesive or adhesive specified above for faces.

2.5 FABRICATION

A. General:
   1. Quality grade for architectural woodwork shall be AWI Premium Grade except that opaque-finished woodwork shall be Custom Grade.
   2. Fabricate architectural woodwork in accord with approved shop drawings.
   3. Apply laminate backing sheet to reverse side of plastic laminate finished surfaces.
   4. Seal faces and edges of medium density fiberboard indicated to be sealed or finished.
   5. Perform veneer operations using hot press method using moisture-resistant, fire-retardant adhesives.
   6. Shop-assemble for delivery to site in units easily handled and to permit passage through building openings. Items which cannot be manufactured in one piece shall have joints at logical breaking points and shall be so noted on shop drawings.
   7. Finger-jointed members will not be allowable for exposed, transparent finish work.
   8. Apply plastic laminate sheets in full uninterrupted sheets consistent with manufactured
sizes. Fit corners and joints hairline; secure with concealed fasteners.
9. Cap exposed plastic laminate finish edges with material of same finish and pattern.
10. When necessary to cut and fit on site, provide materials with ample allowance for cutting. Provide trim for scribing and site cutting.
11. Scribe, miter and accurately join members.
12. Finish work shall be smooth, free from abrasion, tool marks, open joints or raised grain on exposed surfaces.

B. Casework:
1. Fit shelves, doors and exposed edges with matching plastic laminate edging. Use one piece for full length only.
2. Where countertops cannot be provided in single length, join using compression type fasteners.

C. Standing and running trim:
1. Shop prepare and identify components for grain matching during site erection.
2. When necessary to cut and fit on site, provide materials with ample allowance for cutting. Provide trim for searching and site cutting.

PART 3 - EXECUTION

3.1 PREPARATION

A. Prior to pre-installation conference, examine substrates and conditions to receive work. Check that floors and wall substrates are level, plumb and within tolerances to receive work specified in this section.
B. Verify mechanical, electrical and building items affecting work of this section are placed and ready to receive architectural woodwork.
C. Do not begin work until unsatisfactory substrates or conditions have been corrected.

3.2 GENERAL WORKMANSHIP

A. Install woodwork in a manner consistent with the specified Quality Grade, plumb, level, true and straight within 1/8" in 10'-0". Shim as required using concealed shims.
B. Secure to grounds, stripping and blocking with countersunk, concealed fasteners and blind nailing.
1. Use fixture attachments in concealed locations for wall mounted components.
2. Secure cabinet and counter base to floor using angles and anchorages.
C. Scribe and cut for accurate fit to other finished work, with maximum gap of 1/32". Do not use addition overlay trim to conceal larger gaps.
D. Use concealed joint fasteners to align and secure adjoining cabinet units and countertops.
E. Before making cutouts, drill pilot holes at corners.
F. Finish work shall be smooth, free from abrasion, tool marks, raised grain grade markings or similar defects on exposed surfaces.
G. Distribute defects allowed in the quality grade specified to the best overall advantage when installing job assembled work. Install work in accord with approved shop drawings.
H. Touch up mill finished items, including refinishing necessitated by job fitting or attaching and repair of scratches and similar damages. Touch up repairs shall be indiscernible in the finished work.

3.3 INSTALLATION OF STANDING AND RUNNING TRIM

A. Trim and moldings: Install in single unjointed lengths for openings and for runs less than 10'-0". For longer runs, use only one piece less than 10'-0" in straight runs with no piece being less than 4'-0" in length. Join lengths with beveled butt joints. Stagger joints in adjacent members. Cope at returns and miter at corners.

B. Attach and secure in place with uniform joints providing for thermal and building movements.

C. Attachment: Blind anchor where possible. Use finishing nails or trim-head screws where exposed. Set exposed heads for filling. Secure work to framing, anchors or blocking which is built in or directly attached to structural elements.

3.4 FIELD FINISHING

A. Field finish: Field finish transparent finished and painted woodwork in accord with requirements of Painting and Coating section. Prior to finishing, sand using 120 to 180 grit abrasive on a smooth sanding block, to remove scuff and handling marks, raised grain, scratches and effects of moisture exposure.

3.5 CLEANING AND PROTECTION

A. Protect finished and prefinished surfaces from work of other trades.

B. Prior to Date of Substantial Completion, examine work for damage. Repair or replace such damaged work to original condition.

C. Clean wood, metal and accessory items using a neutral cleaner. Check and correct operating mechanism for proper operation. Adjust and lubricate hinges, catches and other operating hardware.
# APPENDIX – SCHEDULE OF SUBMITTALS

<table>
<thead>
<tr>
<th>Submittal Number</th>
<th>Item Number</th>
<th>Description</th>
<th>Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td>06 4100</td>
<td></td>
<td>Architectural Wood Casework</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Submittal</td>
<td></td>
</tr>
<tr>
<td></td>
<td>064100-1.3-A-01</td>
<td>Shop Drawings</td>
<td>Include items from 06 6116 - Solid Surfacing Fabrications</td>
</tr>
<tr>
<td></td>
<td>064100-1.3-B-01</td>
<td>Prod. Data – Plastic Laminate</td>
<td></td>
</tr>
<tr>
<td></td>
<td>064100-1.3-B-02</td>
<td>Prod. Data – Door &amp; Drawer Pulls</td>
<td></td>
</tr>
<tr>
<td></td>
<td>064100-1.3-B-03</td>
<td>Prod. Data – Magnetic Catches</td>
<td></td>
</tr>
<tr>
<td></td>
<td>064100-1.3-B-04</td>
<td>Prod. Data – Concealed Hinges</td>
<td></td>
</tr>
<tr>
<td></td>
<td>064100-1.3-B-05</td>
<td>Prod. Data – Shelf Standards &amp; Supports</td>
<td></td>
</tr>
<tr>
<td></td>
<td>064100-1.3-B-06</td>
<td>Prod. Data – Drawer Slides</td>
<td></td>
</tr>
<tr>
<td></td>
<td>064100-1.3-B-07</td>
<td>Prod. Data – Drawer/Door Lock</td>
<td></td>
</tr>
<tr>
<td></td>
<td>064100-1.3-B-08</td>
<td>Product Data – Wire Management Grommet</td>
<td></td>
</tr>
<tr>
<td></td>
<td>064100-1.3-C-01</td>
<td>Samples – Plastic Laminate</td>
<td>Requested by Architect only if not providing basis of design items</td>
</tr>
<tr>
<td></td>
<td>064100-1.3-C-02</td>
<td>Samples – Door &amp; Drawer Pulls</td>
<td>Requested by Architect only if not providing basis of design items</td>
</tr>
<tr>
<td></td>
<td>064100-1.3-C-03</td>
<td>Samples – Magnetic Catches</td>
<td>Requested by Architect only if not providing basis of design items</td>
</tr>
<tr>
<td></td>
<td>064100-1.3-C-04</td>
<td>Samples – Concealed Hinges</td>
<td>Requested by Architect only if not providing basis of design items</td>
</tr>
<tr>
<td></td>
<td>064100-1.3-C-05</td>
<td>Samples – Shelf Standards &amp; Supports</td>
<td></td>
</tr>
<tr>
<td></td>
<td>064100-1.3-C-06</td>
<td>Samples – Drawer Slides</td>
<td>Requested by Architect only if not providing basis of design items</td>
</tr>
<tr>
<td></td>
<td>064100-1.3-C-07</td>
<td>Samples – Drawer/Door Lock</td>
<td>Requested by Architect only if not providing basis of design items</td>
</tr>
<tr>
<td></td>
<td>064100-1.3-C-08</td>
<td>Samples – Wire Management Grommet</td>
<td>Requested by Architect only if not providing basis of design items</td>
</tr>
</tbody>
</table>
PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Solid surfacing quartz countertops.

B. Related Sections:
   1. Division 01 - Administrative, procedural, and temporary work requirements.
   2. Section 06 4100 - Architectural Wood Casework
   3. Section 07 9200 - Joint Sealers
   4. Section 22 4000 - Plumbing Fixtures

1.2 REFERENCES


1.3 SUBMITTALS

A. Shop Drawings: Indicate dimensions, component sizes, fabrication details, attachment provisions and coordination requirements with adjacent work.
B. Product Data: Indicate product description, fabrication information and compliance with specified performance requirements. Mark manufacturer’s brochures to include only those products proposed for use.
C. Samples: 2 x 2 inch samples showing available colors.
D. Closeout Submittals:
   1. Maintenance Data: Include recommended cleaning materials and procedures for damage repair.

1.4 QUALITY ASSURANCE

A. Fabricator Qualifications: Minimum 5 years experience in work of this Section.

1.5 WARRANTIES

A. Provide manufacturer's warranty against defects in materials. Warranty shall provide for replacement material and labor for a period of fifteen years.
B. Warranty commences at Date of Material Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Acceptable Manufacturers:
   2. LG Hausys America, Inc. - “Viatera” (www.lgviaterausa.com)

B. Substitutions: Under provisions of Division 01.

2.2 MATERIALS

A. Quartz Surfacing:
   1. Material: Quartz agglomerate solid sheets consisting of quartz aggregates bound together with a matrix of filled plastic resin and complying with the “Physical Characteristics of Materials” Article ANSI SS1.
      a. Thickness: minimum ¾ inch.
      b. Color: Match colors scheduled on drawings.
   2. Bowls shall be undermount porcelain bowls as specified in Section 22 4000 Plumbing Fixtures.
   3. Accessory products:
      a. Joint adhesive: Manufacturer’s standard, two-part adhesive kit to create inconspicuous, non-porous joints, with a chemical bond.
      b. Sealant: Manufacturer’s standard mildew-resistant, FDA/UL recognized silicone sealant in color matching surfacing or clear formulations.

B. Sinks: Specified in Section 22 4000 Plumbing Fixtures.

2.3 ACCESSORIES

A. Adhesive:
   1. Type recommended by solid surfacing manufacturer.

B. Joint Sealer: Specified in Section 07 9200 Joint Sealers.

2.4 FABRICATION

A. Fabricate components in shop to sizes and shapes indicated, in accordance with manufacturer’s instructions and approved Shop Drawings.

B. Fabricate splashes and skirts from solid surfacing in color to match countertops.

C. Form joints to be inconspicuous in appearance and without voids. Join pieces with adhesive.

D. Provide holes and cutouts for mounting of accessories.

E. Finish exposed edges to smooth, uniform eased-edge profile.

F. Allowable Tolerances:
   1. Maximum variation in size: 1/16 inch.
   2. Maximum variation in location of openings: 1/16 inch from indicated location.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install components plumb, level and rigid, scribed to adjacent finishes, in accord with approved shop drawings and product data.

B. Form field joints using specified adhesive, with joints inconspicuous in finished work.

C. Install undermount sinks/bowls to countertop using compatible anchors approved by the solid surfacing manufacturer.
D. Provide back and end splashes as indicated on drawings.

E. Provide skirts as indicated on drawings.

F. Adhere countertops, splashes, and skirts with beads of specified color-matched silicone adhesive.

G. Seal perimeter with joint sealer as specified in Section 07 9200. Finish smooth and flush.

H. Allowable Tolerances:
   1. Maximum variation from level and plumb: 1/16 inch in 10 feet, noncumulative.
   2. Maximum variation in plane between adjacent pieces at joint: Plus or minus 1/32 inch.

I. Keep components clean during installation. Remove adhesives, sealants and other stains. Keep clean until Date of Substantial Completion. Replace stained components.

J. Make plumbing connections to sinks in accord with Division 22, Plumbing.

3.2 ADJUSTING
A. Sand out minor scratches and abrasions.

3.3 PROTECTION
A. Protect surfaces from damage with non-staining coverings until Date of Substantial Completion. Replace damaged work which cannot be repaired.

APPENDIX – SCHEDULE OF SUBMITTALS

<table>
<thead>
<tr>
<th>Submittal Number</th>
<th>Item Number</th>
<th>Description</th>
<th>Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td>06 6116</td>
<td></td>
<td>Solid Surfacing Fabrications</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Submittal</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Shop Drawings</td>
<td>Combine with 06 4100 – Architectural Wood Casework</td>
</tr>
<tr>
<td>06 6116-1.3-B-02</td>
<td>Product Data – Solid Surfacing #SS-2</td>
<td></td>
<td></td>
</tr>
<tr>
<td>06 6116-1.3-B-03</td>
<td>Product Data - Adhesive</td>
<td></td>
<td></td>
</tr>
<tr>
<td>06 6116-1.3-C-02</td>
<td>Samples - Solid Surfacing #SS-2</td>
<td>Requested by Architect only if not providing basis of design items</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Project Close-Out Documentation</td>
<td>Provide at date of material completion</td>
<td></td>
</tr>
<tr>
<td>06 6116-1.3-D-01</td>
<td>Maintenance Data</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

END OF SECTION
PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Board insulation at cavity walls

B. Related Sections:
   1. Division 01 - Administrative, procedural, and temporary work requirements.
   2. Section 07 2800 – Self-Adhesive Sheet Cavity Wall Waterproofing.

1.2 REFERENCES

A. ASTM International (ASTM):

1.3 SUBMITTALS

A. Submittals for Review:
   1. Product Data: Indicate product composition and performance characteristics. Mark manufacturer’s brochures to include only those products proposed for use.
   2. Samples: 12 x 12 inch samples of each insulation.

B. Quality Control Submittals:
   1. Certificates of Compliance: Certification from an independent testing laboratory that insulation meets fire hazard classification requirements.

1.4 QUALITY ASSURANCE

A. Fire Hazard Classification:
   1. Noncombustible, tested to ASTM E136.
   2. Flame spread/smoke developed rating of 25/450 or less, tested to ASTM E84.

1.5 DELIVERY, STORAGE AND HANDLING

A. Store insulation in clean, dry, sheltered area, off ground or floor, until used. Protect against wetting and moisture absorption.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Acceptable Manufacturers – Extruded Polystyrene Cavity Wall Insulation:
   1. Dow Chemical Co., Styrofoam, Cavitymate.
   2. Owens Corning, Foamular 150.
   3. Pactiv Building Products, GreenGuard SB Insulation Board.

2.2 MATERIALS

A. Characteristics:
1. Extruded, closed cell extruded polystyrene foam boards complying with ASTM C578-08b, Type X.
2. Thickness: As indicated on drawings.
3. Density: 1.3 pcf, minimum.
4. Aged R value at 75 degrees F: 5.0/inch.
5. Surface burning characteristics: Flame spread of 25 or less and smoke developed 450 or less when tested in accord with ASTM E84-09.
6. Minimum compressive strength: 25 minimum PSI.
7. Water absorption: Maximum 0.3% by volume.
8. Water vapor permeance: Maximum 1.1 perms, tested to ASTM E96/E96M.
9. Sizes: 1'-4" by 8'-0".
10. Edges: Square

2.3 ACCESSORIES

A. Adhesive: Type recommended by insulation manufacturer for application.
B. Tape: Minimum 2 inches wide, pressure sensitive, waterproof.

PART 3 - EXECUTION

3.1 PREPARATION

A. Substrate:
   1. Remove protrusions flush with adjacent surface.
   2. Remove dirt, dust, oil, grease, and other materials that could impair adhesion.

3.2 INSTALLATION

A. General: Comply with manufacturer's product data for each type installation. Install insulation fitted to adjacent construction and with tight joints to provide unbroken thermal barrier. Cut insulation around obstructions and protrusions; fill voids with insulation. Remove projections interfering with installation.
B. Secure extruded polystyrene insulation to sheathing and masonry using adhesive of type recommended by insulation manufacturer. Apply adhesive in full bed 1/8 inch thick.
C. Install boards horizontally in a method to maximize contact bedding and fit snugly between wall ties.
D. Stagger end joints. Butt edges and ends tight to adjacent boards, at perimeter, and around penetrations. Cut and fit insulation tight at perimeter and around penetrations.
E. Tape seal to perimeter and seal vertical and horizontal edges using sealant or joint tape as recommended by the insulation manufacturer.
## APPENDIX – SCHEDULE OF SUBMITTALS

<table>
<thead>
<tr>
<th>Submittal Number</th>
<th>Item Number</th>
<th>Description</th>
<th>Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td>07 2113</td>
<td></td>
<td>Board Insulation</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Submittal</td>
<td></td>
</tr>
<tr>
<td>072113-1.3-A-01</td>
<td></td>
<td>Product Data – Board Insulation</td>
<td></td>
</tr>
<tr>
<td>072113-1.3-A-02</td>
<td></td>
<td>Samples – Board Insulation</td>
<td>Only if requested by Architect</td>
</tr>
<tr>
<td>072113-1.3-B-01</td>
<td></td>
<td>Certificate of Compliance</td>
<td></td>
</tr>
</tbody>
</table>

END OF SECTION
SECTION 07 2115
BATT INSULATION

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Batt insulation in wall and ceiling assemblies.

B. Related Sections:
   1. Division 01 - Administrative, procedural, and temporary work requirements.
   2. 05 4000 - Cold-Formed Metal Framing
   3. 06 1643 - Gypsum Sheathing
   4. 09 2900 - Gypsum Board Assemblies
   5. 09 5100 - Acoustical Ceilings

1.2 REFERENCES

A. ASTM International (ASTM):

1.3 SUBMITTALS

A. Product data: Include product descriptions and installation instructions for each material. Mark manufacturer's brochures to include only those products proposed for use.

B. Quality Control Submittals:
   1. Certificates of Compliance: Certification from an independent testing laboratory that insulation meets fire hazard classification requirements.

1.4 QUALITY ASSURANCE

A. Fire Hazard Classification:
   1. Noncombustible, tested to ASTM E136.
   2. Flame spread/smoke developed rating of 25/50 or less, tested to ASTM E84.

1.5 DELIVERY, STORAGE AND HANDLING

A. Store insulation in clean, dry, sheltered area, off ground or floor, until used. Protect against wetting and moisture absorption.

1.6 PROJECT CONDITIONS

A. Do not install insulation until building is substantially water and weather tight.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Acceptable Manufacturers:

2.2 MATERIALS

A. Thermal Batt Insulation:
   1. Type: ASTM C665, glass fiber composition.
   2. Facing: Unfaced.
   3. Thermal resistance:
      a. 3-1/2 inches thick: R-value of 11.00.
      b. 3-5/8 inches thick: R-value of 13.00.
      c. 6-1/4 inches thick: R-value of 19.00.
      d. 6-1/2 inches thick: R-value of 22.0.
      e. 8-1/2 inches thick: R-value of 25.0.
      f. 9 inches thick: R-value of 26.0.
      g. 10 inches thick: R-value of 30.00.
      h. 12 inches thick: R-value of 38.00.


2.3 ACCESSORIES

A. Tape: Minimum 2 inches wide, pressure sensitive, waterproof.

B. Fasteners: Hot-dip galvanized steel type best suited to application, minimum 5/8 inch penetration into framing.

C. Wire Mesh: Hexagonal steel wire, galvanized.

PART 3 - EXECUTION

3.1 INSTALLATION – WALLS

A. Friction fit between framing members.
   1. Staple or nail in place at maximum 12 inches on center where required for support.
   2. Retain in place with wire mesh secured to framing where required for support.

B. Butt insulation to adjacent construction. Butt ends and edges.

C. Carry insulation around pipes, wiring, boxes, and other components.

D. Ensure complete enclosure of spaces without voids.

E. Tape seal lapped flanges, butt ends, and tears and holes in facings.

3.2 INSTALLATION - CEILINGS

A. Loose-lay insulation above ceiling tiles at locations indicated on drawings.

B. Extend insulation min. 48 inches to either side of partition.
## APPENDIX – SCHEDULE OF SUBMITTALS

<table>
<thead>
<tr>
<th>Submittal Number</th>
<th>Item Number</th>
<th>Description</th>
<th>Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td>07 2115</td>
<td></td>
<td>Batt Insulation</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Submittal</td>
<td></td>
</tr>
<tr>
<td>072115-1.3-A-01</td>
<td></td>
<td>Product Data – Batt Insulation</td>
<td></td>
</tr>
<tr>
<td>072115-1.3-A-02</td>
<td></td>
<td>Product Data - Tape</td>
<td></td>
</tr>
<tr>
<td>072115-1.3-B-01</td>
<td></td>
<td>Certificate of Compliance</td>
<td></td>
</tr>
</tbody>
</table>

END OF SECTION
PART 1 - GENERAL

1.1 SUMMARY:

A. Work of this section includes below slab vapor retarder.

B. Related Sections:
   1. Division 01 - Administrative, procedural, and temporary work requirements.
   2. Section 03 3000 – Cast-In-Place Concrete.

1.2 SUBMITTALS:

A. Product data: Submit manufacturer's product literature and instructions for vapor retarder material and mastic. Mark manufacturer's brochures to include only those products proposed for use.

B. Samples: Submit 1'-0" by 1'-0" samples of vapor retarder.

1.3 QUALITY ASSURANCE:

A. Applicable standards; comply with the following as referenced herein: ASTM International (ASTM).

1.4 DELIVERY, STORAGE AND HANDLING:

A. Deliver materials to project site in manufacturer's original packaging or containers.

B. Store to prevent damage, deterioration or contamination.

1.5 WARRANTIES:

A. Manufacturer shall warrant that vapor retarder will be free from material defects for the life of the building.

PART 2 - PRODUCTS

2.1 CLASS A VAPOR RETARDER:

A. Acceptable products:
   1. Basis of design: Stego Industries, LLC, Stego Wrap 15 mil. (www.stegoindustries.com)
   2. Raven Industries, Inc., VaporBlock 15. (www.ravenind.com)

B. Type: Either polyolefin sheet manufactured from ISO certified virgin resins, polyethylene or polyolefin sheet complying with requirements of ASTM E1745-09, Class A.

C. Characteristics:
   1. Tensile strength when tested in accord with ASTM E154-8a: Minimum 45 lbf/in.
   2. Puncture resistance when tested in accord with ASTM D1709-08, Method B: Minimum 2200 g.
   3. Water vapor permeance when tested in accord with ASTM E96-05, ASTM E154-08a Section F, or ASTM F1249-06: Maximum 0.03 perms.
   4. Thickness: Minimum 15 mils in accord with ACI 302.1R.
2.2 ACCESSORIES:

A. Adhesive or tape: Meeting same performance requirements as vapor retarder and acceptable to manufacturer of vapor retarder material.

B. Vapor proofing mastic: Polymer-modified bituminous/asphalt emulsion complying with requirements of ASTM C836-06.

C. Pipe boots: Prefabricated from same material as membrane in accord with membrane manufacturer’s product data.

D. Manufacturer approved peel-and-stick accessories as required to support screed and forms without penetrating vapor retarder.

PART 3 - EXECUTION

3.1 INSTALLATION UNDER CONCRETE SLAB-ON-GRADE:

A. Install vapor retarder in accord with ASTM E1643-11 and in accord with manufacturer’s product data, over compacted, clean subgrade material, free of debris and protrusions.

B. Lay vapor retarder over interior building area to receive concrete slab. Apply membrane in full sheet widths. Lay membrane with seams parallel to and lapped in direction of concrete pour. Extend vapor barrier to the perimeter of the slab. If practicable, terminate at the top of the slab. At the point of termination, seal vapor barrier to the foundation wall, grade beam or slab itself. Seal around penetrations such as utilities and columns in order to create a monolithic membrane between the surface of the slab and moisture sources below the slab and at slab perimeter.

C. Lap vapor retarder over footings or seal to foundation wall, or both, and seal around penetrations such as utilities and columns in order to create a monolithic membrane between the surface of the slab and moisture sources below the slab and at slab perimeter.

D. Lap joints minimum 6” and seal with adhesive, pressure sensitive tape, or adhesive/tape combination over entire lap; comply with membrane manufacturer’s installation instructions.

E. Only apply seam tape to clean and dry vapor retarder.

F. Seal to penetrations and protrusions by turning membrane up a minimum of 6” and sealing membrane edges to penetrations and protrusions with adhesive and tape, mastic or use manufacturer’s prefabricated boot in accord with membrane manufacturer’s product data. Fold at corners to form envelope.

G. Where expansion or control joints are indicated in slab, lay vapor retarder continuous under joint filler.

H. The use of non-permanent stakes driven through vapor retarder is prohibited. For interior forming applications, utilize vapor retarder manufacturer approved peel-and-stick accessories.

I. Use reinforcing bar supports with base sections that eliminate or minimize the potential for puncture of the vapor barrier.

J. If continuous barrier of vapor retarder is compromised, repair as recommended by vapor retarder manufacturer.

K. Completed vapor retarder is to provide a continuous edge-to-edge barrier under the slab.
3.2 PROTECTION:

A. Protect vapor retarder installation from damage until concrete slab is in place.

B. Prior to placement of concrete, repair damaged vapor retarder with vapor retarder material installed in accord with manufacturer’s product data.

C. Lap beyond damaged areas a minimum of 6” and seal as prescribed for sheet joints.

APPENDIX – SCHEDULE OF SUBMITTALS

<table>
<thead>
<tr>
<th>Submittal Number</th>
<th>Item Number</th>
<th>Description</th>
<th>Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td>07 2616</td>
<td></td>
<td>Underslab Vapor Retarder</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Submittal</td>
<td></td>
<td></td>
</tr>
<tr>
<td>072616-1.2-A-01</td>
<td>Product Data – Underslab Vapor Retarder</td>
<td></td>
<td></td>
</tr>
<tr>
<td>072616-1.2-B-01</td>
<td>Samples - Underslab Vapor Retarder</td>
<td>Requested by Architect only if not providing basis of design items</td>
<td></td>
</tr>
</tbody>
</table>
PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Sheet materials for controlling moisture movement at exterior wall assemblies.

B. Related Sections:
   1. Division 01 - Administrative, procedural, and temporary work requirements.
   2. Section 06 1643 - Gypsum Sheathing
   3. Section 07 2113 - Board Insulation

1.2 REFERENCES

A. ASTM International (ASTM):
   1. D226 - Standard Specification for Asphalt Saturated Organic Felt Used in Roofing and
      Waterproofing.
   3. E331 - Standard Test Method for Water Penetration of Exterior Windows, Doors, and
      Curtain Walls by Uniform Static Air Pressure Differential.

1.3 SUBMITTALS

A. Submittals for Review:
   1. Product Data: Include manufacturer's descriptive data, technical data, and tested
      physical and performance properties
   2. Samples: 12 x 12 inch moisture barrier samples.

1.4 QUALITY ASSURANCE

A. Provide continuous barrier to moisture infiltration [, air infiltration and exfiltration,] [and] [water vapor transmission], flashed to discharge incidental condensation and water penetration.

B. Installer Qualifications:
   1. Minimum 2 years experience in work of this Section.
   2. Approved by moisture barrier manufacturer.
   3. Licensed by ABAA to ABAA Quality Assurance Program.
   4. Employ ABAA-certified installers and supervisors on Project.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Acceptable Manufacturers - Sheet Moisture Barriers:
   1. DuPont. (www.tyvek.com)
   2. Griffolyn, Division of Reef Industries. (www.reefindustries.com)

B. Substitutions: Under provisions of Division 01.

2.2 MATERIALS
A. Sheet Moisture Barriers:

B. Asphalt Impregnated Felt: ASTM D226, No. 15, non-perforated.

2.3 ACCESSORIES

A. Fasteners: Hot-dip galvanized or fluoropolymer coated steel screws with 1 inch diameter plastic washers, minimum 5/8 inch penetration into framing.

B. Joint Tape: Minimum 2 inches wide, pressure sensitive, waterproof, of type recommended by moisture barrier manufacturer.

C. Flashing Sheet: Type recommended by moisture barrier manufacturer.

D. Primer: Type recommended by moisture barrier manufacturer.

E. Patching Compound: Type recommended by moisture barrier manufacturer.

PART 3 - EXECUTION

3.1 PREPARATION

A. Clean surfaces to receive moisture barrier; remove loose and foreign matter that could impair adhesion or performance.

B. Protect adjacent and underlying surfaces.

C. Apply joint tape centered over sheathing joints. Lap ends 2 inches minimum. Press to full bond with substrate without voids, wrinkles, bridging, or fishmouths.

3.2 INSTALLATION - SHEET MOISTURE BARRIERS

A. Provide complete and continuous barrier.

B. Apply primer when required by moisture barrier manufacturer.

C. Install moisture barrier without tears, voids, and holes.

D. Begin application at low point; weatherlap succeeding courses minimum 4 inches.

E. Lap ends 6 inches minimum. Tape seal lapped ends and edges.

F. Fasten at maximum 12 inches on center.

G. Seal to door and window frames, around penetrations, and at perimeter with flashing sheet. Press to full bond with substrate without voids, wrinkles, bridging, or fishmouths.

H. Refer to manufacturer's Residing Installation Guidelines.

3.3 FIELD QUALITY CONTROL

A. Inspect moisture barrier for damage just prior to covering.

B. Clean damaged areas and cover with additional moisture barrier material minimum 6 inches larger than damaged area on all sides. Seal to main moisture barrier with continuous tape.
### APPENDIX – SCHEDULE OF SUBMITTALS

<table>
<thead>
<tr>
<th>Submittal Number</th>
<th>Item Number</th>
<th>Description</th>
<th>Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td>07 2800</td>
<td></td>
<td>Self-Adhesive Sheet Cavity Wall Waterproofing</td>
<td></td>
</tr>
<tr>
<td></td>
<td>072800-1.3-A-01</td>
<td>Product Data - Sheet Moisture Barriers</td>
<td></td>
</tr>
<tr>
<td></td>
<td>072800-1.3-A-02</td>
<td>Product Data - Asphalt Impregnated Felt</td>
<td></td>
</tr>
<tr>
<td></td>
<td>072800-1.3-A-03</td>
<td>Product Data - Joint Tape</td>
<td></td>
</tr>
<tr>
<td></td>
<td>072800-1.3-A-04</td>
<td>Product Data – Flashing Sheet</td>
<td></td>
</tr>
<tr>
<td></td>
<td>072800-1.3-A-05</td>
<td>Product Data - Primer</td>
<td></td>
</tr>
<tr>
<td></td>
<td>072800-1.3-A-06</td>
<td>Product Data – Patching Compound</td>
<td></td>
</tr>
<tr>
<td></td>
<td>072800-1.3-B-01</td>
<td>Samples - Sheet Moisture Barriers</td>
<td>Requested by Architect only if not providing basis of design items</td>
</tr>
<tr>
<td></td>
<td>072800-1.3-B-02</td>
<td>Samples - Asphalt Impregnated Felt</td>
<td>Only if requested by Architect</td>
</tr>
</tbody>
</table>
PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Preformed metal roof panel system.
   2. Underlayment.
   3. Fascia.
   4. Soffits.
   5. Flashings, trim, anchorage, and accessories.

B. Related Sections:
   1. Division 01 - Administrative, procedural, and temporary work requirements.
   2. Section 05 2000 – Steel Joists.
   3. Section 05 3100 – Steel Deck.
   4. Section 07 6200 – Sheet Metal Flashing & Trim
   5. Section 07 9200 - Joint Sealers.

1.2 REFERENCES

A. American Architectural Manufacturers Association (AAMA):
   1. 621 - Voluntary Specifications for High Performance Organic Coatings on Coil Coated Architectural Hot Dipped Galvanized (HDG) and Zinc-Aluminum Coated Steel Substrates.

B. ASTM International (ASTM):

C. Factory Mutual Research Corporation (FM).

1.3 SYSTEM DESCRIPTION

A. Design Requirements; design roof system to withstand:
   1. Thermal movement: Completed metal roofing and flashing system shall be capable of withstanding expansion and contraction of components caused by a temperature range of 160 degrees F without buckling, producing excess stress on structure, anchors or fasteners, or reducing performance.
   2. Uniform wind load capacity: Installed roof system shall withstand positive and negative design wind loading pressures as indicated on the drawings and as required by the International Building Code, 2012 Edition with the 2014 Georgia State Amendments, with a maximum system deflection of L/120 and a maximum panel deflection of 0.04%.
   4. UL wind uplift resistance classification: Roof assembly when tested in accord with UL 580 shall be classified as Class 90.
   5. Concentrated load capacity: System shall withstand a load of 250 lbs. applied to four sq. in. area located in the center of the panel between stiffener ribs, without buckling of ribs or permanent panel distortion.

B. Performance Requirements:
   1. Static pressure air infiltration: Completed roof system shall have maximum of 0.08 cfm/sq. ft. with 6.24 psf air pressure differential in accord with ASTM E1680-11.
   3. Water penetration (dynamic pressure): No uncontrolled water penetration when exposed to dynamic rain and 90 mph wind velocities for not less than five minutes duration, when tested in accord with principles of AAA 501.1.
   4. Capacities for gauge, span or loading other than those tested may be determined by interpolation of test results within the range of test data. Extrapolation for conditions outside test range are not acceptable.
   5. Fire rating: Class A rated assemblies when tested in accord with UL 263 and UL 790.
   6. Hail impact rating: Class 4 when tested in accord with UL 2218.

1.4 SUBMITTALS

A. Shop Drawings:
   1. Indicate roof system with flashings and accessories in plan and elevation; sections and details at full scale.
   2. Indicate metal thicknesses and finishes, panel lengths, joining details, anchorage details, flashings and special fabrication provisions for termination and penetrations, girt locations, expansion provisions and supports.
   3. Indicate relationships with adjacent and interfacing work.
   4. Indicate location of penetrations with relation to rib placement.
   5. Indicate panel joint locations in roof layout.

B. Product Data: Include manufacturer’s detailed material and system description, installation instructions, engineering performance data and finish specifications. Mark manufacturer’s brochures to include only those products proposed for use.
C. Intent to warrant: Submit an intent to warrant, executed by authorized representative of metal roof manufacturer, indicating that manufacturer has reviewed drawings, specifications and conditions affecting the work, and proposes to provide warranties as referenced herein without further stipulation.

D. Certification:
1. Submit certification that proposed applicator is approved for warranted work by metal roof manufacturer.
2. Submit certification from authorized representative of metal roof manufacturer, stating that surfaces and conditions are acceptable for purpose of providing specified warranty.
3. Submit certification from authorized representative of metal roof manufacturer, stating that proposed roof system meets design and performance criteria, and specified requirements.
4. Submit certification from authorized representative of metal roof manufacturer that specified metal roof systems have been satisfactorily installed on projects of similar scope and size and have been completed for seven years.
5. Submit written certification that fluoropolymer coating complies with specified performance requirements.
6. Submit certification from manufacturer that fabricator/Installer is approved and certified to fabricate/install manufacturer warranted metal roof systems as specified herein.

E. Design calculations: Submit design calculations, indicating compliance with specified performance criteria. Indicate fastener types and spacings. Design calculations shall bear the seal of a professional Engineer licensed in the State of Georgia. Indicate that Engineer has reviewed shop drawings.

F. Samples:
1. Submit samples of panel section, at least 2'-0" in length by full width, indicating thickness, profile, texture and color.
2. Submit samples of panel clips, closures and accessory items.
3. Submit color sample chips for confirmation; chip to be minimum 3 inch x 5 inch.

G. Test Reports:
1. Submit reports by an independent testing laboratory to support structural calculations and show compliance with specified performance criteria.
2. Tests shall have been made for identical systems within the ranges of specified performance criteria.
3. If test data is not available or if data does not represent project conditions, Contractor shall be responsible for securing satisfactory tests by an independent agency acceptable to Design Professional, with costs of such testing borne by the Contractor.

1.5 QUALITY ASSURANCE

A. Manufacturer’s qualifications:
1. Metal roof system manufacturer shall have been engaged in the manufacture of metal roof systems similar to those specified herein for a minimum of ten years.
2. Manufacturer shall submit evidence that his proposed metal roof system as specified herein has been satisfactorily installed on projects of similar scope and size, which have been completed for at least five years.

B. Fabricator/Installer qualifications:
1. Fabricator/installer shall be trained and approved by metal roof system manufacturer, with trained supervisory personnel observing and directing the work.
2. If required, proposed fabricator/installer shall submit evidence of financial responsibility.
3. Design Professional reserves the right to inspect fabrication facilities in determining qualifications.
4. Fabricator/installer shall have satisfactorily installed metal roof systems, similar in size and scope to the specified system, which have been completed for five years.
5. Fabricator/installer shall be approved and certified to install metal roof systems which can be warranted by the metal roof manufacturer.

C. Pre-installation meeting:
   1. Prior to beginning metal roof work, hold a pre-installation meeting at project site to discuss compliance with requirements of Contract Documents. Give two weeks advance notice to participants, including Contractor, metal roofing subcontractor, metal roof system manufacturer’s representative and subcontractor who have equipment penetrating roof or whose work involves access to roof shall be present.
   2. Contractor shall record minutes of meeting and shall distribute copies of minutes to attending parties.
   3. Advise Design Professional of scheduled meeting date two weeks in advance of meeting date.

1.6 DELIVERY, STORAGE AND HANDLING
   A. Protect components during fabrication, shipment, storage, handling and erection from mechanical abuse, stains, discoloration and corrosion.
   B. Maintain strippable plastic protective film on finished surfaces until panels are erected.
   C. Handle materials to prevent damage to surfaces, edges and ends of roofing sheets and sheet metal items. Damaged material shall be rejected and removed from site.
   D. Protect panels from wind-related damages.
   E. Inspect materials upon delivery. Reject and remove physically damaged or marred material from project site.

1.7 PROJECT/SITE CONDITIONS
   A. Weather Limitations: proceed with installation only when existing and forecasted weather conditions permit metal roof panel work to be performed.
   B. Field Measurements: Verify actual dimensions of construction contiguous with metal roof panels by field measurements before fabrication.
   C. Ascertain that work of other trades which penetrates roof or is to be made watertight by roof is in place and approved prior to installation of roofing.
   D. Protection:
      1. Provide protection or avoid traffic on completed roof surfaces.
      2. Avoid overloading roof with store materials.
      3. Support no roof-mounted equipment directly on roofing system.

1.8 ROOF SYSTEM PERFORMANCE TESTING
   A. General Performance: Metal roof panels shall comply with performance requirements without failure due to defective manufacture, fabrication, installation or other defects in construction.
   B. Roof System shall be designed to meet Standard Building Code Wind Load requirements.
   C. Panels to meet:
      1. Water Penetration: When tested per ASTM E-283/1680 and ASTM E-331/1646 there shall be no uncontrolled water penetration or air infiltration through the panel joints.
2. Roof System shall be designed to meet a UL Class 90 wind uplift in accordance with UL standard 580 and panel system shall be ASTM 1592 Tested and approved.

3. UL 2218 - Impact Resistance rated.

1.9 Warranties

A. Weathertight warranty: Manufacturer’s standard form in which manufacturer agrees to repair or replace standing seam metal roof panel assemblies that fail to remain weathertight, including leaks, within specified warranty period.
   1. Warranty Period: 20 Years from date of Substantial Completion

B. Finish warranty: Manufacturer’s standard form in which manufacturer agrees to repair finish or replace standing seam metal roof panels that show evidence of deterioration of factory-applied finish within specified warranty period.
   1. Exposed Panels Finish - deterioration includes 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 a paint to adhere to a bare metal.
   2. Warranty Period: 35 Years from the date of substantial completion

C. Applicator shall furnish written warranty for a two (2) year period from date of substantial completion of building covering repairs required to maintain roof and flashings in watertight condition.

D. Warranties shall commence on Date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS:

A. Acceptable Manufacturers:

B. Roof panels, fascia and soffits shall be the products of a single manufacturer.

C. Substitutions: Under provisions of Division 01.

2.2 MATERIALS:

A. Roof Panels:
   1. Basis of design: Pac-Clad Snap-Clad.
   2. Preformed roofing panels shall be fabricated of 24 GA Steel.
   3. Provide factory-formed metal roof panels designed to be installed by lapping and interconnecting raised side edges of adjacent panels with joint type indicated and mechanically attaching panels to supports using concealed clips in side laps. Include clips, cleats, pressure plates and accessories required for a weathertight installation.
   4. Roof panels shall be standing seam in 16 inch widths with 1 ¾ inch high seam.
   5. Panels to be produced with factory supplied hot melt mastic in the seams.
   6. Panels to be produced smooth.
   7. Panels to be designed for attachment with concealed fastener clips, spaced as required by the manufacturer to provide for both positive and negative design loads, while allowing for the expansion and contraction of the entire roof system resulting from variations in temperature.
   8. Forming: Use continuous end rolling method. No end laps on panels. No portable rollforming machines will be permitted on this project, no installer-owned or installer-
rented machines will be permitted. It is the intent of the Architect to provide Factory-Manufactured panel systems only for this project.

9. Trim: Trim shall be fabricated of the same material and finish to match the profile, and will be press broken in lengths of 10 to 12 feet. Trim shall be formed only by the manufacturer of their approved dealer. Trim to be erected in overlapped condition. Use lap strips only as indicated on drawings. Miter conditions shall be factory welded material to match the sheeting.

10. Closures: use composition or metal profiled closures at the top of each elevation to close ends of the panels. Metal closures to be made in the same material and finish as face sheet.

B. Fascia:
   1. Fascia sheets shall be fabricated of ASTM B-209 quality aluminum, 3105-H14 Alloy and Temper material. Aluminum shall be tension leveled (temper passed and stretcher leveled) with camber of a maximum of 1/4" in 20 feet, and shall be .032 inch thick aluminum, US standard grade.
   2. Trim: Trim shall be fabricated of the same material and finish to match the profiled sheeting and press broken in lengths of 10 - 12 feet. Trim shall be formed only by the manufacturer or their approved dealer. Trim to be erected in overlapped condition. Use lap strips only as indicated on drawings. Miter conditions shall be factory welded material to match the sheeting.
   3. Fasteners: Fasteners shall be 400 series stainless steel, dished washers stainless steel with bonded neoprene.

C. Soffit:
   1. Basis of design: Pac-Clad PAC-750 Full Vent.
   2. Preformed soffit panels shall be fabricated of ASTM B-209 quality aluminum, 3105-H14 Alloy and Temper material. Aluminum shall be tension leveled (temper passed and stretcher leveled) with camber of a maximum of 1/4" in 20 feet, and shall be .032 inch thick aluminum, US standard grade.
   3. Soffit panels shall be full vent and 12 inch width.
   4. Forming: use continuous and rolling method. No end laps on panels. No "portable rollforming" machines will be permitted on this project; no installer-owned or installer-rented machines shall be permitted. It is the intent of the Architect to provide Factory-Manufactured soffit systems only for this project.
   5. Trim: Trim shall be fabricated of the same material and finish to match the profiled sheeting and press broken in lengths of 10 - 12 feet. Trim shall be formed only by the manufacturer or their approved dealer. Trim to be erected in overlapped condition. Use lap strips only as indicated on drawings. Miter conditions shall be factory welded material to match the sheeting.
   6. Fasteners: Fasteners shall be 400 series stainless steel, dished washers stainless steel with bonded neoprene.
   7. Zees: Where required by design of primary structural framing system, zees shall be used to span between beams and/or other joists. Thermally responsive base and top clips shall be fastened to the zees on 12 inch centers.

D. Metal Finish:
   1. Finish on exposed surfaces:
      a. Liquid Fluoropolymer Steel Sheet Coil Coatings, AAMA 621: Minimum 70 percent PVDF resin by weight, in color coat and clear topcoat.
         1) Basis of design: Valspar (Sherwin-Williams Company) “Fluoron Classic.”
      b. Pencil Hardness, ASTM D 3363: HB to 2H.
      c. Salt Spray Resistance, ASTM B 117: 1,000 hours.
      d. Humidity Resistance, ASTM D 2247: 2,000 hours.
      e. Dry Film Thickness, ASTM D 7091: Fluoron Classic
         1) Primer Coat: 0.2 to 0.30 mil.
         2) Color Coat: 0.70 to 0.80 mil.
3) Clear Coat: 0.40 to 0.50 mil.
4) Total Thickness: 1.30 to 1.60 mils.

f. Color:
1) Roofing: Match Valspar #439RZ3688M SR Harvest Brown.
2) Fascia: Match Valspar #439RZ3667M SR Chocolate.
3) Soffits: Match Valspar #439RZ3899M SR Flint.

2. Finish on unexposed surfaces: Neutral washout.
3. Protective surfacing: Provide strippable plastic film covering on finished surfaces to prevent abrasion during fabrication, storage and handling.

2.3 ROOF INSULATION:

A. Isocyanurate roof insulation:
1. Type: Rigid isocyanurate closed-cell foam boards, permanently bonded to non-asphaltic glass facing sheets complying with ASTM C1289-13, Class 1, Type II.
2. Face size: Minimum 4'-0" by 4'-0".
3. Total thickness: Two layers of 2 inch thickness each; totaling 4 inches.
5. Fire hazard classification: FM Class I.

2.4 SELF-ADHERING SHEET MEMBRANE ROOF UNDERLAYMENT

A. Manufacturers:
1. Acceptable manufacturers:
   a. Basis of design: W.R Grace "Ice & water Shield"
   b. Carlisle CCW WIP 300HT
   c. Tamko TW Tile and Metal Underlayment
2. Substitutions: Under provisions of Division 01.

B. Materials:
1. Material: Cold applied, self-adhering membrane composed of a high strength polyethylene film coated on one side with a layer of rubberized asphalt adhesive and interwound with a disposable release sheet. An embossed, slip resistant surface is provided on the polyethylene.
2. Color: Gray-black.
3. Membrane Thickness: 40 mil (1.02 mm) ASTM D3767 procedure A (Section 9.1).
4. Tensile Strength, Membrane: 250 psi (1720 kN/m2) ASTM D412 (Die C modified).
5. Elongation, Membrane: 250% ASTM D412 (Die C modified).
6. Low Temperature Flexibility: Unaffected @ -20°F (-29°C) ASTM D1970.
7. Adhesion to Plywood: 3.0 lbs/in. width (525 N/m) ASTM D903.
8. Permeance (Max): 0.05 Perms (2.9 ng/m2s Pa) ASTM E96.
9. Material Weight Installed (Max): 0.3 lb/ft2 (1.3 kg/m2) ASTM D461.

2.5 ACCESSORIES:

A. Fasteners: Fasteners shall be of type, material, size, corrosion resistance, holding power and other properties required to fasten miscellaneous framing members to substrates.

B. Sealants:
1. Exterior grade silicone sealant recommended by roofing manufacturer.

PART 3 - EXECUTION

3.1 PREPARATION
A. Examination:
   1. Examine existing conditions to ensure surfaces are suitable for installation of roofing underlayment before proceeding with installation.
   2. Examine alignment and placement of substrates before proceeding with installation of metal roof.
   3. Examine alignment and placement of penetrations before proceeding with installation of metal roof.
   4. Verify flashing has been installed.
   5. Starting work indicates installer’s acceptance of existing conditions.

3.2 INSTALLATION

A. Insulation:
   1. Install insulation with roof system anchor clips, in two layers, with joints staggered between layers. Stagger end joints in adjacent boards. Butt edges for snug contact. Bear edges of board on deck ribs.
   2. Install only as much roof insulation each work period as can be covered by roofing by end of same work period.

B. Self-adhering sheet membrane underlayment:
   1. Install waterproof membrane underlayment at all areas to receive metal roof.
   2. Install membrane underlayment fully adhered to substrates in accord with manufacturer’s product data.
   3. Do not install underlayment on wet or frozen substrates.
   4. Install when surface temperature of substrate is a minimum of 40 degrees F (5 degrees C) and rising.
   5. Remove dust, dirt, loose materials and protrusions from deck surface.
   6. Install membrane on clean, dry, continuous structural deck. Fill voids and damaged or unsupported areas prior to installation.
   7. If required, prime surfaces to receive membrane materials. Allow primer to dry until tack-free. Prime only area which can be covered with sheet membrane during work period. Reprime surfaces which are not covered within 24 hours of primer application.
   8. Install membrane materials with side and ends lapped as recommended by product data. Begin installation at low points, lapping succeeding sheets to shed water.
   9. Membrane applications shall be fully adhered, smooth, straight and free of blisters, buckles, fishmouths and wrinkles affecting the complete adherence of the membrane. Patch and repair defective work in accord with manufacturer’s product data. Replace defective areas.
   10. Double membrane at changes in plane by application of a centered membrane strip. Cover strip completely with full width sheet.
   11. Seal around protrusions and at terminations in accord with product data.
   12. Repair punctures and tears in membrane by patching with membrane material.

C. Roof panels and flashing:
   1. Install roof and flashing in accord with approved shop drawings and manufacturer’s product data, within specified erection tolerances.
   2. Penetrations:
      a. Locate penetrations in flat of panel.
      b. No rib shall be cut or modified to accommodate penetrations or flashing of penetrations.
      c. Provide for temperature expansion/contraction movement of panels at roof penetrations and roof-mounted equipment in accord with system manufacturer’s product data and design calculations.
      d. Provide EPDM rubber flashing boots for vents, pipes, stacks, hoses and round legs of equipment supports. Mechanically attach base flange and tighten hose clamp to provide watertight installation.
   3. Install roof panels, flashing and trim with finish direction oriented in the same direction.
4. Isolate dissimilar metals and masonry or concrete from metals with bituminous coating. Use gasketed fasteners to prevent corrosive action between fastener, substrate and roof panels.
5. Fasteners shall be concealed.
6. Anchorage shall allow for temperature expansion/contraction movement within specified range without stress or elongation of roof panels, clips or anchors. Attach clips to decking using self-drilling screws of size and spacing in accord with manufacturer’s product data and design calculations to resist specified uplift and thermal movement forces.
7. Seal laps and joints in accord with roof system manufacturer’s product data.
8. Coordinate flashing and sheet metal work to provide weathertight conditions at roof terminations. Fabricate and install in accord with standards of SMACNA “Architectural Sheet Metal Manual” and NRCA “Construction Details,” using continuous cleats at all exposed edges.
9. Installed system shall be true to line and plane and free of dents, oilcans and physical defects.
10. Installation tolerances:
   a. Variation from location: Plus or minus ¼ inch.
   b. Variation from plane: ¼ inch in 10 feet.
11. Form joints in linear sheet metal to allow for ½ inch minimum expansion at 20'-0" o.c., maximum, and 8'-0" from corners. Provide 6 inch wide cover plate and 1'-0" wide backup late at intersections. Form plates to profile of sheet metal item.
12. At joints in linear sheet metal items, set sheet metal over backup plate and set cover plate over sheet metal in two beads of specified silicone sealant, ¼ inch in diameter, minimum. Extend sealant over all metal surfaces. Mate components for positive seal. Allow no sealant to migrate onto exposed surfaces.
13. Remove all strippable coating and provide a dry-wipe down cleaning of the panels as they are erected.

D. Fascia:
1. Install fascia in accord with approved shop drawings and manufacturer’s product data, within specified erection tolerances.
2. Install fascia with finish direction oriented in the same direction.
3. Isolate dissimilar metals and masonry or concrete from metals with bituminous coating. Use gasketed fasteners to prevent corrosive action between fastener, substrate and fascia.
4. Fasteners shall be concealed.
5. Anchorage shall allow for temperature expansion/contraction movement within specified range without stress or elongation of fascia, clips or anchors. Attach clips to decking using self-drilling screws of size and spacing in accord with manufacturer’s product data and design calculations to resist specified uplift and thermal movement forces.
6. Seal laps and joints in accord with fascia system manufacturer’s product data.
7. Installed system shall be true to line and plane and free of dents, oilcans and physical defects.
8. Installation tolerances:
   a. Variation from location: Plus or minus ¼ inch.
   b. Variation from plane: ¼ inch in 10 feet.
9. Form joints in linear sheet metal to allow for ½ inch minimum expansion at 20'-0" o.c., maximum, and 8'-0" from corners. Provide 6 inch wide cover plate and 1'-0" wide backup late at intersections. Form plates to profile of sheet metal item.
10. At joints in linear sheet metal items, set sheet metal over backup plate and set cover plate over sheet metal in two beads of specified silicone sealant, ¼ inch in diameter, minimum. Extend sealant over all metal surfaces. Mate components for positive seal. Allow no sealant to migrate onto exposed surfaces.
11. Remove all strippable coating and provide a dry-wipe down cleaning of the panels as they are erected.
E. Soffit panels:
   1. Install soffit panels in accord with approved shop drawings and manufacturer’s product data, within specified erection tolerances.
   2. Install soffit panels with orientation as indicated on the Drawings.
   3. Isolate dissimilar metals and masonry or concrete from metals with bituminous coating. Use gasketed fasteners to prevent corrosive action between fastener, substrate and panels.
   4. Fasteners shall be concealed.
   5. Anchorage shall allow for temperature expansion/contraction movement within specified range without stress or elongation of panels, clips or anchors.
   6. Installed system shall be true to line and plane and free of dents, oilcans and physical defects.
   7. Installation tolerances:
      a. Variation from location: Plus or minus ¼ inch.
      b. Variation from plane: ¼ inch in 10 feet.
   8. Soffit panels attached to any treated lumber must have an appropriate vapor barrier installed over the treated lumber prior to installing any soffit panels or related flashings. Do not allow any metal products to come into direct contact with treated lumber.
   9. Remove all strippable coating and provide a dry-wipe down cleaning of the panels as they are erected.

3.3 ADJUSTING

A. Touch up field cuts and abrasions on finished surfaces to match factory finish.
# APPENDIX – SCHEDULE OF SUBMITTALS

<table>
<thead>
<tr>
<th>Submittal Number</th>
<th>Item Number</th>
<th>Description</th>
<th>Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td>07 4113</td>
<td></td>
<td>Metal Roof Panels</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td><strong>Submittal</strong></td>
<td></td>
</tr>
<tr>
<td>07 4113-1.3-A-01</td>
<td></td>
<td>Shop Drawings</td>
<td></td>
</tr>
<tr>
<td>07 4113-1.3-B-01</td>
<td></td>
<td>Product Data – Metal Roof Panels</td>
<td></td>
</tr>
<tr>
<td>07 4113-1.3-B-02</td>
<td></td>
<td>Product Data - Fascia</td>
<td></td>
</tr>
<tr>
<td>07 4113-1.3-B-03</td>
<td></td>
<td>Product Data - Soffits</td>
<td></td>
</tr>
<tr>
<td>07 4113-1.3-B-04</td>
<td></td>
<td>Product Data – Roof Insulation</td>
<td></td>
</tr>
<tr>
<td>07 4113-1.3-B-05</td>
<td></td>
<td>Product Data – Self-Adhering Sheet Membrane Roof Underlayment</td>
<td></td>
</tr>
<tr>
<td>07 4113-1.3-C-01</td>
<td></td>
<td>Intent to Warrant</td>
<td></td>
</tr>
<tr>
<td>07 4113-1.3-D-01</td>
<td></td>
<td>Certification</td>
<td></td>
</tr>
<tr>
<td>07 4113-1.3-E-01</td>
<td></td>
<td>Design Calculations</td>
<td></td>
</tr>
<tr>
<td>07 4113-1.3-F-01</td>
<td></td>
<td>Samples – Metal Roof Panels</td>
<td></td>
</tr>
<tr>
<td>07 4113-1.3-F-02</td>
<td></td>
<td>Samples - Panel Clips, Closures &amp; Accessory Items</td>
<td>Provide only if requested by Architect</td>
</tr>
<tr>
<td>07 4113-1.3-F-03</td>
<td></td>
<td>Samples – Color Chip</td>
<td></td>
</tr>
<tr>
<td>07 4113-1.3-G-01</td>
<td></td>
<td>Test Reports</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td><strong>Project Close-Out Documentation</strong></td>
<td>Provide at date of material completion</td>
</tr>
<tr>
<td>07 4113-1.9-A-01</td>
<td></td>
<td>Weathertight Warranty</td>
<td></td>
</tr>
<tr>
<td>07 4113-1.9-B-01</td>
<td></td>
<td>Finish Warranty</td>
<td></td>
</tr>
<tr>
<td>07 4113-1.9-C-01</td>
<td></td>
<td>Installation Warranty</td>
<td></td>
</tr>
</tbody>
</table>

END OF SECTION
PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Aluminum composite panel system.
   2. Metal support components.
   3. Flashings, trim, and accessories.
   4. Soffit vents.

B. Related Sections:
   1. Division 01 - Administrative, procedural, and temporary work requirements.
   2. Section 07 9200 - Joint Sealers.

1.2 REFERENCES

A. American Society of Civil Engineers (ASCE) 7 - Minimum Design Loads for Buildings and Other Structures.

B. American Architectural Manufacturers Association (AAMA):
   1. 508 - Voluntary Test Method and Specifications for Pressure Equalized Rain Screen Wall Cladding Systems.
   2. 611 - Voluntary Specification for Anodized Architectural Aluminum.

C. ASTM International (ASTM):

1.3 SYSTEM DESCRIPTION

A. Metal Wall Panel Assembly: Metal wall panels, attachment system components and accessories necessary for a complete weather-tight system.

1.4 PERFORMANCE REQUIREMENTS

A. General: Provide metal wall panel assemblies that comply with performance requirements specified as determined by testing manufacturers’ standard assemblies similar to those indicated for this Project, by a qualified testing and inspecting agency.

B. Air Infiltration: Air leakage through assembly of not more than 0.06 cfm/sq. ft. of wall area when tested according to ASTM E 283 at a static-air-pressure difference of 6.24 lbf/sq. ft.
C. Water Penetration: No water penetration when tested according to ASTM E 331 at a wind-load design pressure of not less than 15 psf.

D. Structural Performance: Provide metal wall panel assemblies capable of withstanding the effects of gravity loads and the following loads and stresses within limits and under conditions indicated, based on testing according to ASTM E 330-84:
   1. Wind Loads: Determine loads based on the following minimum design wind pressures:
   2. Uniform pressure of 75 psf, inward or outward.
   3. Deflection Limits: Engineer metal wall panel assemblies to withstand test pressures with deflection no greater than 1/180 of the span and no evidence of material failure, structural distress, or permanent deformation exceeding 0.2 percent of the clear span.

E. Fire-Resistance Ratings: Where indicated, provide metal wall panels identical to those of assemblies tested for fire resistance per ASTM E 119 by a testing and inspecting agency acceptable to authorities having jurisdiction.

F. Surface-Burning Characteristics: Provide insulated metal wall panels having insulation-core materials with the following surface-burning characteristics as determined by testing identical products per ASTM E 84 under UL or another testing and inspecting agency acceptable to authorities having jurisdiction:
   1. PE Core:
      a. Flame-Spread Index: 0 or less, unless otherwise indicated.
      b. Smoke-Developed Index: 0 or less, unless otherwise indicated.

1.5 SUBMITTALS

A. Shop Drawings: Show fabrication and installation layouts of metal wall panels; details of edge conditions, joints, panel profiles, corners, anchorages, attachment system, trim, flashings, closures, and accessories; and special details.
   1. Accessories: Include details of all integral panel components and their interface with adjacent materials.
   2. 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.

B. Product Data: Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for each type of metal wall panel and accessory. Mark manufacturer's brochures to include only those products proposed for use.

C. Samples for Initial Selection: For each type of metal wall panel indicated with factory-applied color finishes.
   1. Include manufacturer's standard color charts consisting of strips of cured sealants showing the full range of colors available for each sealant exposed to view.
   2. Include manufacturer's standard color charts showing full range of colors available, in specified finish type, for the metal panel system.

D. Samples for Verification:
   1. Metal Wall Panels: Two (2) each, six inches by ten inches minimum, panel samples with joinery included as part of the sample.
   2. Accessories: Twelve-inch long samples for each type of accessory.
   3. Exposed Sealants: For each type and color of joint sealant required. Install joint sealants in ½-inch wide joints formed between two (2) six-inch long strips of material matching the appearance of metal wall panels adjacent to joint sealants.

E. Compatibility and Adhesion Test Reports: From sealant manufacturer indicating the
following:
1. Materials forming joint substrates and joint sealant backings have been tested for compatibility and adhesion with joint sealants.
2. Interpretation of test results and written recommendations for primers and substrate preparation needed for adhesion.

F. Product Test Reports: Based on evaluation of comprehensive tests performed by a qualified testing agency, for the following:
1. Metal Panels: Include reports for air infiltration, water penetration, structural performance, and Large Missile Impact.

G. Maintenance Data: For metal wall panels to include in maintenance manuals.

H. Quality Control Submittals:
1. Certification: Manufacturer's certification that panel system meets specified design and performance criteria.

1.6 QUALITY ASSURANCE

A. Panel System Fabricator:
1. System Fabricator’s responsibilities include engineering and fabricating metal wall panel assemblies and when required, provide professional engineering services needed to assume engineering responsibility.
2. Drawing Responsibility: Preparation of Shop Drawings and comprehensive engineering analysis by the fabricator, not a subcontractor.

B. Fabrication Location: Panels to be factory assembled at Fabricator's plant/shop. Panels shall not be assembled on-site.

C. Installer: Must be certified by metal-faced composite wall panel Fabricator to install Fabricator’s wall panel system.

D. Testing Agency Qualifications: Qualified according to ASTM E 329 for testing indicated, as documented according to ASTM E 548.

E. Source Limitations: Obtain each type of metal wall panel through one source from a single fabricator.

F. Product Options: Drawings indicate size, profiles, and dimensional requirements of metal wall panels and are based on the specific system indicated.

1.7 DELIVERY, STORAGE AND HANDLING

A. Deliver components, sheets, metal wall panels, and other manufactured items so as not to be damaged or deformed. Package metal wall panels for protection during transportation and handling.

B. Unload, store, and erect metal wall panels in a manner to prevent bending, warping, twisting, and surface damage.

C. Stack metal wall panels on platforms, pallets, or within crates, covered with suitable weather-tight and ventilated covering. Store metal wall panels to ensure dryness, with positive slope for drainage of water. Do not store metal wall panels in contact with other materials that might cause staining, denting, or other surface damage.

D. Leave protective strippable film as applied by ACM sheet manufacturer on panel face throughout fabrication and installation. Remove only after panels are installed and not
subject to damage.

1.8 PROJECT CONDITIONS

A. Field Measurements: Verify locations of structural members and wall opening dimensions by field measurements before metal wall panel fabrication.

1.9 WARRANTIES

A. System 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 (2) years.

B. 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. Panel Finish: Deterioration includes, but is not limited to, the following:
      a. Color fading more than 5 Hunter units when tested according to ASTM D 2244.
      b. Chalking in excess of a No. 8 rating when tested according to ASTM D 4214.
      c. Cracking, checking, peeling, or failure of paint to adhere to bare metal.
   2. Finish Warranty Period: Twenty (20) years.

C. Warranties commence at Date of Material Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURER: ALUMINUM COMPOSITE MATERIAL (ACM)

A. Acceptable Manufacturers:
   1. Basis of design: Reynobond - Alcoa Architectural Products. (www.alcoa.com)
   2. Alcan Composites USA, Inc.
   3. Armetco Systems

B. Substitutions: Under provisions of Division 01.

2.2 PANEL MATERIALS

A. Composite Metal Panel System
   1. Exposed Sealant System
      a. Panel system shall be nominal two-inch depth with shop applied, concealed continuous perimeter extrusions. (Note: Intermittent extrusions at panel perimeter are not acceptable.) Panel system shall employ shop attached clips with sliding capability for exact location over supports, while allowing for thermal movement in all four directions.
      b. Panel system shall have nominal 1/2" vertical and horizontal joinery. Joint sealants to be provided and installed per Specification Section 07900.
      c. Panel system shall be fabricated in a shop environment. Field assembled systems are not permissible.
      d. Panel system shall be provided in panel modules and lengths as indicated on the Contract drawings (up to 60" in the short direction and up to 240" in the long direction).
e. Standard route and return systems with fixed fastening through fixed perimeter extrusions or clips shall not be permitted.

B. ACM – Aluminum Composite Material: Formed with 0.020-inch thick coil-coated aluminum sheet facings. ACM sheets to be formed in a continuous, in-line process utilizing thermoset adhesive and pressure to achieve the following minimum bond strength between the metal facings and the core:
   1. ACM Thickness: 0.157 inch (4 mm)
   2. Core: Standard (PE)
   3. Bond Strength: (ASTM C297): 1500 psi minimum (PE core)
   4. Finish shall consist of a 70% fluoropolymer resin that complies with AAMA 2605 standards.
   5. Exposed Finish
      a. Color: As indicated on the drawings.
      b. Coating shall consist of a 0.2 mil (approx.) prime coat and a 0.8 mil (approx.) finish coat containing 70% Kynar 500® resins.
      d. Pencil hardness: ASTM D3363 shall be F-2H minimum.
      e. Flexibility T-Bend: ASTM D4145 shall be 0-2T-Bend; no pick-off.
      f. Adhesion: ASTM D3359 reverse impact 1/16” crosshatch shall show no cracking or adhesion loss.
      g. Reverse Impact: ASTM D2794 1500 x metal thickness aluminum shall show no cracking or adhesion loss.
      h. Acid Resistance: ASTM D1308, 10% muriatic acid, 24 hrs., shall show no effect. 20% sulfuric acid, 18 hrs, shall show no effect.
      i. Acid Rain Test: Kesternich SO2, DIN 500180, 10 cycles min. No objectionable color change.
   6. Backside/Concealed Finish: Backside of panels to be coated with manufacturer’s standard backside washcoat.

2.3 ACCESSORIES

A. Wall Panel Accessories: Provide components required for a complete metal wall panel assembly including trim, copings, fasciae, splines, corner units, clips, flashings, sealants, gaskets, fillers, closure strips, and similar items. Match material and finish of metal wall panels, unless otherwise indicated.

B. Continuous Aluminum Soffit Vents:
   1. Basis of design: SV-75-V-300 by Fry Reglet.
   2. Finish: Match composite metal wall panels.
   3. Color: Match composite metal wall panels.

2.4 FABRICATION

A. General: Fabricate and finish metal wall panels and accessories at the factory to greatest extent possible, by fabricator’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. Form panel lines, breaks and angles to be sharp and true, with surfaces free from warp and buckle.

B. Fabricate metal wall panels in a manner that would weep any possible condensation to the exterior.

C. Provide panel profile for full length of panel.
D. Fabricate metal wall panel joints in a manner that will minimize noise from movements within panel assembly.

E. Metal-Faced Composite Wall Panels:
   1. Fabricate panels, as required to comply with deflection limits, without the use of backside panel stiffeners.
   2. Fabricate panels with sharply cut edges, with no displacement of face sheets or external exposure of core material.
   3. Dimensional Tolerances:
      a. Length: Plus 0.375 inch (9.5 mm).
      b. Width: Plus 0.188 inch (4.8 mm).
      c. Thickness: Plus or minus 0.008 inch (0.2 mm).
      d. Panel Bow: 0.8 percent maximum or panel length or width.
      e. Squareness: 0.2 inch (5 mm) maximum.

2.5 FINISHES, GENERAL

A. Comply with NAAMM’s “Metal Finishes Manual for Architectural and Metal Products” for recommendations for applying and designating finishes.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances, metal wall panel supports, and other conditions affecting performance of work.
   1. Examine primary and secondary 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 metal wall panel manufacturer.
   2. Examine solid wall sheathing to verify that sheathing joints are supported by framing or blocking and that installation is within flatness tolerances required by metal wall panel manufacturer.

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

3.2 COMPOSITE WALL PANEL INSTALLATION, GENERAL

A. General: Install metal wall panels in orientation, sizes, and locations indicated on approved shop drawings. Install panels perpendicular to girts and subgirts, unless otherwise indicated. Anchor metal wall panels and other components of the Work securely in place, with provisions for thermal and structural movement.

B. Install attachment system required to support wall panels and to provide a complete weathertight wall system, including subgirts, perimeter extrusions, tracks, panel clips, and anchor channels as may be required.
   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 water barrier and flashings that will be concealed by composite panels are installed.

C. Clip Installation: Attach integral panel clips to supports at locations, spacings, and with fasteners recommended by system fabricator. Panel clips to be attached to panels at the factory in lieu of field applied.
   1. Seal horizontal and vertical joints between adjacent panels with sealant backing and sealant. Install sealant backing and sealant according to requirements specified in Division 7 Section “Joint Sealants”.

Bidding Documents - October 31st 2018 07 4243-6 Composite Metal Wall Panels
3.3 ERECTION TOLERANCES

A. Installation Tolerances: Shim and align metal wall panel units within installed tolerance of 1/4-inch in 20-feet (6-mm in 6-m), non-accumulative, 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.

3.4 CLEANING AND PROTECTION

A. Remove temporary protective coverings and strippable films, if any, as metal wall panels are installed, unless otherwise indicated in manufacturer’s written installation instructions. On completion of metal wall panel installation, clean finished surfaces as recommended by metal wall panel manufacturer. Maintain in a clean condition during construction.

APPENDIX – SCHEDULE OF SUBMITTALS

<table>
<thead>
<tr>
<th>Submittal Number</th>
<th>Item Number</th>
<th>Description</th>
<th>Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td>07 4243-1.3-A-01</td>
<td>Shop Drawings</td>
<td></td>
<td></td>
</tr>
<tr>
<td>07 4243-1.3-B-01</td>
<td>Product Data – Composite Metal Panel System</td>
<td></td>
<td></td>
</tr>
<tr>
<td>07 4243-1.3-B-02</td>
<td>Product Data - Wall Panel Accessories</td>
<td></td>
<td></td>
</tr>
<tr>
<td>07 4243-1.3-B-03</td>
<td>Product Data - Continuous Aluminum Soffit Vents</td>
<td></td>
<td></td>
</tr>
<tr>
<td>07 4243-1.3-C-01</td>
<td>Samples for Initial Selection</td>
<td></td>
<td></td>
</tr>
<tr>
<td>07 4243-1.3-D-01</td>
<td>Samples for Verification</td>
<td></td>
<td></td>
</tr>
<tr>
<td>07 4243-1.3-E-01</td>
<td>Compatibility and Adhesion Test Reports</td>
<td></td>
<td></td>
</tr>
<tr>
<td>07 4243-1.3-F-01</td>
<td>Product Test Reports</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Project Close-Out Documentation</strong></td>
<td><strong>Provide at date of material completion</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>07 4243-1.3-G-01</td>
<td>Maintenance Data</td>
<td></td>
<td></td>
</tr>
<tr>
<td>07 4243-1.3-H-01</td>
<td>Manufacturer’s Certification</td>
<td></td>
<td></td>
</tr>
<tr>
<td>07 4243-1.9-A-01</td>
<td>System Warranty</td>
<td></td>
<td></td>
</tr>
<tr>
<td>07 4243-1.9-B-01</td>
<td>Panel Finish Warranty</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

END OF SECTION
SECTION 07 6200
SHEET METAL FLASHING AND TRIM

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
1. Metal flashings and trim.
2. Edge flashings.
3. Gutters, scuppers, conductor heads, and downspouts.
5. Counterflashings at utility penetrations.

B. Related Sections:
1. Section 04 2000 - Unit Masonry
2. Section 07 4213 - Metal Wall Panels
3. Section 07 5400 - TPO Membrane Roofing
4. Section 07 6100 - Sheet Metal Roofing
5. Section 07 9200 - Joint Sealers.

1.2 REFERENCES

A. American Architectural Manufacturers Association (AAMA):
1. 611 - Voluntary Specification for Anodized Architectural Aluminum.
2. 621 - Voluntary Specifications for High Performance Organic Coatings on Coil Coated Architectural Hot Dipped Galvanized (HDG) and Zinc-Aluminum Coated Steel Substrates.


C. ASTM International (ASTM):
1. A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy Coated (Galvannealed) by the Hot-Dip Process.
2. A666 - Standard Specification for Annealed or Cold-Worked Austenitic Stainless Steel Sheet, Strip, Plate, and Flat Bar.

D. Sheet Metal and Air Conditioning Manufacturer’s Association International (SMACNA) - Architectural Sheet Metal Manual.

1.3 SUBMITTALS

A. Shop drawings: Indicate material types, sizes, shapes, thicknesses, finishes, fabrication
details, anchors, connections, expansion joints and relation to adjacent work. Details and profiles shall be drawn at full scale.

B. Product data: Indicate product description, finishes and installation instructions for manufactured products, including interface with adjacent materials and surfaces. Mark manufacturer’s brochures to include only those products proposed for use.

C. Samples; submit for special finishes: 6” by 6” samples for verification of color by Architect.

D. Submittals schedule: Obtain Architect’s acceptance of submittals prior to pre-roofing conference.

1.4 QUALITY ASSURANCE

A. Fabricator and Installer Qualifications: Minimum 5 years experience in work of this Section.

B. Design, fabricate, and install edge flashings in accordance with ANSI/SPRI ES-1.

1.5 DELIVERY, STORAGE & HANDLING

A. Store materials off ground, under cover. Protect from damage and deterioration.

B. Handle materials to prevent damage to surfaces, edges and ends of sheet metal items. Damaged material shall be rejected and removed from site.

1.6 WARRANTIES

A. Warrant sheet metal flashing and trim work to be free of defects in materials and workmanship for two years.

B. Finish warranty: Warrant fluoropolymer coating to remain free of checking, crazing, peeling, chalking or fading for a period of thirty (30) years.

C. Warranty periods shall begin at Date of Certificate of Material Completion.

PART 2 - PRODUCTS

2.1 SHEET METAL MATERIALS


1. Miscellaneous sheet metal flashing and trim: Minimum 24 ga., factory painted.

B. Roofing cement: As recommended by roof membrane manufacturer.

C. Fasteners: Same material or compatible with sheet metal being fastened.

1. Nails: Flat head, needle point, not less than 12 ga. and of sufficient length to penetrate substrate 1" minimum.

2. Expansion shields: Lead or bronze sleeves.


4. Bolts: Furnished complete with nuts and washers.

5. Rivets: Round head, solid type.

6. Blind clips and cleats: Same gauge as sheet metal.

D. Silicone sealant for concealed joints:
1. Acceptable products:
   a. Dow Corning Corp., #795.
   b. Pecora Corp., #895.
2. Type: One-part silicone rubber; meeting ASTM C920-08, Type S, Grade NS, Class 25.

E. Bituminous coating for separation of dissimilar materials: Cold-applied, asphalt roofing cement meeting SSPC-PS 9.01, minimum 30 mils thickness.

2.2 FINISHES

A. Fluoropolymer coating finish:
   1. Three coat, shop-applied, baked-on fluoropolymer coating system based on minimum 70% Arkema Group, Kynar 500, Solvay Solexis, Inc., Hylar 5000 resin or equal (Polyvinylidene fluoride, PVDF), formulated by a licensed manufacturer and applied by manufacturer's approved applicator to meet AAMA 2605.
   2. Color: Selected by Architect from Manufacturer’s full range.
   3. Finish on unexposed surfaces: Neutral washout.
   4. Work to receive fluoropolymer coating includes flashing and sheet metal exposed to view from building elevations.

2.3 SHEET METAL FABRICATION

A. Fabricate sheet metal work in accord with approved shop drawings and applicable standards. Form sheet metal work with clear, sharp and uniform arrises. Hem exposed edges. Form curved components to radius indicated on the drawings, without deformation in metal.

B. Make joints using flatlock seams, 3/4" in width. Fill seams with exterior sealant.

C. Provide linear sheet metal items in 10'-0" to 12'-0" sections, except as otherwise noted. Form flashing using single pieces for the full width. Provide shop-fabricated, one-piece corners and transition pieces, with maximum 2'-0" long legs.

D. Make riveted joints using solid shank rivets or pop rivets as applicable. Pop rivets shall be closed end type.

E. Profiles:
   1. Gutters: As indicated on Drawings.
   2. Downspouts: As indicated on Drawings.
   3. Fabricate end caps, downspout outlets and headers, straps, brackets, and downspout strainers in profile to suit gutters and downspouts.

F. Provide for thermal expansion and contraction in sheet metal:
   1. Gutters:
      a. Place expansion joints at maximum 50 feet on center.
      b. Locate expansion joints between downspouts; prevent water flow over joint.
   2. Other sheet metal:
      a. Provide expansion joints in sheet metal exceeding 15 feet in running length.
      b. Place expansion joints at 10 feet on center maximum and maximum 2 feet from corners and intersections.
   3. Joint width: Consistent with types and sizes of materials, minimum width 1/4 inch.

G. Fabricate expansion joints in edge flashings with backing and cover plates formed to flashing profile, minimum 8 inches long.

H. Unless otherwise indicated, provide minimum 3/4 inch wide flat lock seams; lap in direction of water flow.
I. Fabricate cleats and starter strips of same material as sheet metal.

2.4 ACCESSORIES

A. Downspout Boots:
   1. Cast aluminum downspout boot
   2. Basis of design: Model B25C by Barry Pattern & Foundry (www.barrycraft.com)
   a. Substitutions: Under provisions of Division 01.
   3. Provide at each downspout.

PART 3 - EXECUTION

3.1 SHEET METAL INSTALLATION

A. Install work in accord with approved shop drawings and applicable standards. Sheet metal items shall be true to line, without buckling, creasing, warp or wind in finished surfaces.

B. Coordinate flashing at roof surfaces with roofing work to provide weathertight condition at roof terminations.

C. Perform field joining of lengths as specified for shop fabrication.

D. Isolate dissimilar materials to prevent electrolysis. Separate using bituminous coating.

E. Seaming: Form seams in direction of flow. Fill seams with exterior sealant. Lap seams occurring in members sloping 45 degrees or more than 4", minimum; bed in flashing cement.

F. Secure sheet metal items using continuous cleats, clips and fasteners as indicated. Perform no exposed face fastening.

G. Fastening:
   1. Nails: Confine to one edge only of flashing 1'-0" or less in width. Space at 4" o. c., maximum. Provide neoprene washers for nails.
   2. Cleats: Continuous, formed to profile of item being secured.
   3. Clips: Minimum 2" wide by 3" long, formed to profile of item being secured. Space at 2'-0" o. c., maximum.

H. Form joints in linear sheet metal to allow for ½" minimum expansion at 12'-0" o. c., maximum, and maximum 2'-0" from corners. Provide 6" wide cover plate and 1'-0" wide backup plate at intersections. Form plates to profile of sheet metal item.

I. At joints in linear sheet metal items, set sheet metal over backup plate and set cover plate over sheet metal in two beads of specified silicone sealant, 1/4" in diameter, minimum. Mate components for positive seal. Allow no sealant to migrate onto exposed surfaces.

J. Where sheet metal is indicated as flashing above and below heads of doors, windows and other penetrations, extend flashing minimum 8" beyond opening, each side. Turn ends up minimum 2" to form end dams and to ensure drainage through weeps and not into cavity.

K. Install perimeter metal cap flashing in 10'-0" lengths with backup plates at joints.
   1. Secure perimeter metal cap flashing in reglet with lead wedges installed at 2'-0" o. c., maximum. Hammer wedges to a depth which will not interfere with sealant or backer rod. Place wedge at each length so that wedges are within 8" of joint, without interfering with splice plates.
   2. Install sealant in accord with Joint Sealants section, to form fillet bead minimizing holding of water.
L. Gutters: Secure with straps spaced maximum 36 inches on center and within 12 inches of ends.

M. Downspouts:
   1. Secure with straps spaced maximum 8 feet on center and within 2 feet of ends and elbows.
   2. Flash downspouts into gutters or conductor heads and fasten.
   3. Flash upper sections into lower sections minimum 2 inches at joints; fasten sections together.

N. Apply joint sealers as specified in Section 07 9200.

3.2 CLEANING

A. Clean sheet metal; remove slag, flux, stains, spots, and minor abrasions without etching surfaces.

APPENDIX – SCHEDULE OF SUBMITTALS

<table>
<thead>
<tr>
<th>Submittal Number</th>
<th>Item Number</th>
<th>Description</th>
<th>Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td>07 6200</td>
<td></td>
<td>Sheet Metal Flashing</td>
<td></td>
</tr>
<tr>
<td></td>
<td>07 6200-1.3-A-01</td>
<td>Shop Drawings</td>
<td></td>
</tr>
<tr>
<td></td>
<td>07 6200-1.3-B-01</td>
<td>Product Data – Sealant for Concealed Joints</td>
<td></td>
</tr>
<tr>
<td></td>
<td>07 6200-1.3-B-02</td>
<td>Product Data - Fluoropolymer Coating Finish</td>
<td></td>
</tr>
<tr>
<td></td>
<td>07 6200-1.3-B-03</td>
<td>Product Data – Flashing Reglet System</td>
<td></td>
</tr>
<tr>
<td></td>
<td>07 6200-1.3-C-01</td>
<td>Samples - Fluoropolymer Coating Finish</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Project Close-Out Submittal</td>
<td>Provide at date of material completion</td>
<td></td>
</tr>
<tr>
<td></td>
<td>07 6200-1.6-A-01</td>
<td>System Warranty</td>
<td></td>
</tr>
<tr>
<td></td>
<td>07 6200-1.6-B-01</td>
<td>Warranty - Fluoropolymer Coating Finish</td>
<td></td>
</tr>
</tbody>
</table>

END OF SECTION
SECTION 07 6500
FLEXIBLE FLASHING

PART 1 - GENERAL

1.1 SUMMARY
A. Section Includes:
   1. Work of this section includes flexible through-wall flashing system.
B. Related Sections:
   1. Division 01 - Administrative, procedural, and temporary work requirements.

1.2 REFERENCES

1.3 SUBMITTALS
A. Product data: Indicate material type, composition, thickness and installation procedures. Mark manufacturer's brochures to include only those products proposed for use.
B. Samples: Submit 1'-0" by 1'-0" samples of material.

1.4 PROJECT CONDITIONS
A. Do not apply flashings at ambient or surface temperatures less than 40 degrees F.

PART 2 - PRODUCTS

2.1 SELF-ADHERING FLEXIBLE MEMBRANE FLASHING
A. Acceptable products, subject to compliance with specified requirements:
   2. Carlisle SynTec, Inc., CCW-705-TWF.
   3. Fortifiber Building Products Systems Group, FortiFlash.
   5. Or equal.
B. Characteristics:
   1. Type: Adhesive-backed rubberized asphalt compound, bonded to 8 mil, high density, cross-laminated polyethylene film. Adhesive side coated with release paper.
   3. Surface conditioner/primer and mastic/sealant: Membrane manufacturer's standard components. Surface conditioner/prime shall be formulated to provide tenacious bond with substrates, including those coated with dampproofing or asphaltic materials.

2.2 ACCESSORIES
A. Termination Mastic: Type recommended by flashing manufacturer.

2.3 STAINLESS STEEL FLASHING FOR SUPPORT
A. Stainless steel: Minimum 24 ga., AISI Type 302/304 alloy, 2B finish.
PART 3 - EXECUTION

3.1 INSTALLATION OF SELF-ADHERING MEMBRANE FLASHING

A. Install flashing in accord with manufacturer’s product data and as specified herein to prevent moisture from entering wall or to redirect it exterior.

B. Install flashing at exterior door heads, window heads and sills, other wall openings, lintels, shelf angles and at weep hole locations, continuous, in same bed joint as weep hole.

C. Prime substrates to receive membrane flashing using specified primers, and complying with membrane manufacturer’s instructions. Primed substrates shall allow full bond of adhesive side of membrane to substrates. Should full bond at top edge not be immediately evident, mechanically attach a 1” wide, continuous, hot-dipped galvanized steel termination bar at top edge of flashing, against backup substrate, fastened at 2'-0" o.c. maximum.

D. At masonry and concrete backup:
   1. At double wythe masonry walls, install stainless steel drip edge at outside face in accord with flashing manufacturer’s product data. Start self-adhering membrane flashing 1/2” in from outside face of exterior wythe, extend through cavity, rising minimum 6” above top of mortar net, and terminate minimum 1” above mortar joint of interior wythe, in accord with membrane manufacturer's details. Seal top edge with continuous bead of mastic.
   2. At concrete walls, install stainless steel drip edge at outside face in accord with flashing manufacturer’s product data. Start self-adhering membrane flashing 1/2” in from outside face of exterior wythe, extend through cavity, rising minimum 6” above top of mortar net. Terminate against substrate, in accord with membrane manufacturer's details. Seal top edge with continuous bead of mastic.
   3. Overlap flashing 2” and roll overlaps with a steel hand roller. Apply a bead of mastic/sealant along top edge, seams and cuts of flashing in accord with product data.
   4. Top flashing with full bed of fresh mortar as masonry is continued.

E. At stud walls with masonry veneer: Install stainless steel drip edge at outside face in accord with flashing manufacturer’s product data. Start flashing 1/2” in from outside face of exterior wythe, extend through cavity, rising not less than 8” above weeps and minimum 6” above mortar net, where mortar net is present. Terminate flashing against sheathing.
   1. Set in continuous 1-1/2” wide bed of adhesive, and mechanically fastened to each framing stud.
   2. Overlap flashing 2” and roll overlaps with a steel hand roller. Apply a bead of mastic/sealant along top edge, seams and cuts of flashing in accord with product data.
   3. Top flashing with full bed of fresh mortar as masonry is continued.

F. Extend flashing minimum 8” beyond openings, each side. Turn ends up minimum 2” to form enddams and to ensure drainage through weeps and not into cavity.

G. Install in maximum lengths to avoid joints. Fold corners without cutting. Apply a detail coat of liquid mastic over the folds.

H. Adhere flashing to shelf angle. Provide adhesive cant to force water to exterior.

I. Where flexible flashing is unsupported, at cavity wall for example, provide stainless steel flashing to support flexible flashing.

J. Ensure that membrane flashing is provided with operable weeps spaced and located as specified in Architectural Concrete Unit Masonry section. Weeps shall be above finished grade. For flashing at roofing or back of parapet wall conditions, place lowest flashing joints and weeps in joint just above reglets or termination of top edge of roof base flashing.
## APPENDIX – SCHEDULE OF SUBMITTALS

<table>
<thead>
<tr>
<th>Submittal Number</th>
<th>Item Number</th>
<th>Description</th>
<th>Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td>07 6500</td>
<td></td>
<td>Flexible Flashing</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Submittal</td>
<td></td>
<td></td>
</tr>
<tr>
<td>076500-1.3-A-01</td>
<td>Product Data – Flexible Membrane Flashing</td>
<td></td>
<td></td>
</tr>
<tr>
<td>076500-1.3-A-02</td>
<td>Product Data – Termination Mastic</td>
<td></td>
<td></td>
</tr>
<tr>
<td>076500-1.3-B-01</td>
<td>Samples - Flexible Membrane Flashing</td>
<td>Requested by Architect only if not providing basis of design items</td>
<td></td>
</tr>
</tbody>
</table>
PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Firestopping perimeter of and penetrations through fire and smoke rated assemblies.

B. Related Sections:
   1. Division 01 - Administrative, procedural, and temporary work requirements.
   2. Section 08 1113 - Hollow Metal Frames
   3. Section 08 7100 - Door Hardware
   4. Section 09 9000 - Painting

1.2 REFERENCES

A. ASTM International (ASTM):

B. Underwriters Laboratories, Inc. (UL):
   1. 1479 - Fire Tests of Through-Penetration Firestops.

1.3 SYSTEM DESCRIPTION

A. Provide continuous protection against passage of heat, fire, smoke, and gases at perimeter of and penetrations through rated assemblies.

1.4 SUBMITTALS

A. Product Data:
   1. Firestopping schedule; prepare in tabular format and identify:
   2. Type of assembly receiving firestop and required fire rating.
   3. Type of penetrating item.
   4. Proposed firestop system.
   5. Include UL or equivalent details for each firestop system.
   6. Mark manufacturer's brochures to include only those products proposed for use.


C. Certificates of Compliance: Indicate conformance of installed systems with specified requirements.

1.5 QUALITY ASSURANCE

A. Applicator Qualifications: Minimum 5 years experience in work of this Section.

B. Firestopping: Fire resistance rating equivalent to adjacent construction; tested to ASTM E814, ASTM E1966, ASTM E2307, UL 1479, or UL 2079.
1.6 DELIVERY, STORAGE AND HANDLING

A. Deliver firestopping materials in original, unopened containers or packages with intact and legible manufacturers' labels identifying product and manufacturer.

B. Store and handle firestopping materials in accord with manufacturer's product data.

1.7 PROJECT CONDITIONS

A. Do not apply sealants, mortars, or putties when temperature of substrate material and surrounding air is below 40 degrees F or is anticipated to drop below that temperature within 24 hours after installation.

PART 2 - PRODUCTS

2.1 MATERIALS, GENERAL:

A. VOC Content: Penetration firestopping sealants and sealant primers shall comply with the following limits for VOC content when calculated according to 40 CFR 59, Subpart D (EPA Method 24):
   1. Sealants: 250 g/L.
   2. Sealant Primers for Nonporous Substrates: 250 g/L.
   3. Sealant Primers for Porous Substrates: 775 g/L.

2.2 THROUGH-PENETRATION FIRESTOP SYSTEMS:

A. Acceptable manufacturers:
   1. Hilti USA.
   2. 3M Fire Protection Products.
   4. The RectorSeal Corp.
   5. Specified Technologies, Inc. (STI).
   6. Tremco, Inc.


C. Materials: UL Classified for use in through-penetration firestop systems.
   1. Firestop sealant: Single-component, elastomeric silicone or endothermic latex sealant compound; self-adhering, flexible and watertight; non-sag and self-leveling types as required.
   2. Firestop foam: Two-part, room temperature vulcanizing, silicone elastomer, non-combustible foam void seal.
   5. Intumescent composite sheets: Composite sheets composed of organic/inorganic intumescent elastomeric core bonded on one side to 28 ga. galvanized steel sheet and other side reinforced with steel wire mesh, covered with aluminum foil.
   6. Mineral wool or ceramic fiber safing: Non-combustible fiber tested in accord with ASTM E136-12, with melting point in excess of 2000 degrees F.; flame spread of 15 maximum and 0 smoke development when tested in accord with ASTM E84-13a. Thickness and density shall be as required by Through-Penetration Firestop System
D. Accessories:
1. Primers, adhesives and backer rods: As required by manufacturer's product data and system designs.
2. Forming, damming and packing materials: Types as indicated in Through-Penetration Firestop Systems.
3. Restricting collars: Manufacturer's standard design as required for firestop system.
4. Fasteners, anchor clips, sleeves, clamps, spacers, ties, cover plates and miscellaneous accessories: Provide as required by manufacturer's product data and in accord with Through-Penetration Firestop System designs.

2.3 THROUGH-PENETRATION FIRESTOP DEVICES:

A. Acceptable manufacturers:
1. Hilti USA.
2. Isolatex International, Inc.
4. ProSet Systems, Inc.
5. Specified Technologies, Inc. (STI).
6. Tremco, Inc.


C. Accessories: Provide sealants, adhesives, fasteners, sleeves, clamps, spacers, anchor clips, ties and accessories in accord with manufacturer's product data and as required for complete installation.

2.4 FIRESTOP SEALANTS:

A. Acceptable products:
1. Hilti USA, CP 601S Firestop Sealant.
2. Nelson Firestop Products, CLK.
3. 3M Fire Protection Products, Fire Barrier Silicone Sealant 2000 N/S.
5. The RectorSeal Corp., Metacaulk 835+.

B. Characteristics: Single-component, self-adhering, flexible, watertight, elastomeric silicone sealant compound; UL Classified. Provide self-leveling type for horizontal applications, non-sag type for all other applications.

2.5 SAFING:

A. Acceptable products; subject to compliance with specified requirements:
1. Thermal Ceramics, Cerablanket F.S.
2. Thermafiber Inc., Thermafiber Safing Insulation.

B. Characteristics:
1. Material: Semi-rigid mineral fiber insulation, meeting ASTM C665-12b, Type 1.
2. Density: 4.0 pcf.
3. Thickness: As required to meet specified requirements.
4. Facing: Unfaced or reinforced foil facing, based on UL Design selected.
5. Fire resistance properties:
b. Non-combustible: As defined by ASTM E136-12 and NFPA.
c. Fire hazard characteristics: Maximum flame spread of 15 and smoke development of 5 when tested in accord with ASTM E84-13a (unfaced).

2.6 ACCESSORIES

A. Forming and Damming Materials: As recommended by firestopping manufacturer for intended use.
   1. Permanent: Mineral fiber board, mineral fiber matting, or mineral fiber putty.
   2. Temporary: Plywood, particle board, or other.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine areas to receive firestopping materials prior to beginning work. Verify that opening areas and dimensions for penetrations to receive firestopping systems and devices do not exceed design requirements.

B. Remove projections interfering with installation. Prepare surfaces in accord with manufacturer's product data and UL Through-Penetration Firestop Devices Numbers.

3.2 PREPARATION

A. Priming: Prime substrates where recommended by firestopping manufacturer using that manufacturer's recommended products and methods. Confine primers to areas of bond. Do not allow spillage and migration onto exposed surfaces.

B. Masking tape: Use masking tape to prevent firestopping from contacting adjoining surfaces that will remain exposed upon completion of the Work. Remove tape as soon as it is possible to do so without disturbing the firestopping seal with substrates.

3.3 INSTALLATION

A. General:
   1. Comply with manufacturer's product data and UL Classified for Through-Penetration Firestop Devices Numbers.
   2. Install firestopping materials fitted to adjacent construction to fill voids.
   3. Firestop penetrations through fire-rated walls, partitions, floors and floor/ceiling assemblies with tested assemblies in accord with UL 1479 or with a through-penetration firestop system or device when tested in accord with ASTM E814-13a.
   4. Firestopping shall comply with code requirements.

B. Fire and smoke barrier identification:
   1. Fire walls, fire barriers, fire partitions, smoke barriers and smoke partitions or any other rated wall required to have protected openings shall be effectively and permanently identified with signs or stenciling in a manner acceptable to the Authority having Jurisdiction.
   2. Such identification shall be:
      a. Located in accessible concealed floor, floor-ceiling or attic spaces.
      b. Located within 15'-0" of the end of each wall and at intervals not exceeding 30'-0" measured horizontally long the wall or partition.
      c. Include lettering not less than 3" in height with a minimum 3/8" stroke in a contrasting color.
3. **Suggested wording for fire and smoke barriers:** "______ HOUR FIRE AND SMOKE BARRIER – PROTECT ALL OPENINGS."

C. **Through-penetration firestop systems and devices:**
   1. Install at penetrations through fire-rated floor and wall construction, including partitions and floor/ceiling assemblies, in accord with manufacturer's product data and UL System Numbers. Provide materials and accessories as required.
   2. Install intumescent type firestop systems where plastic piping, cable, conduit and other combustible items, including insulated metal pipes, penetrate fire-rated construction.
   3. At Contractor's option, through-penetration firestop devices of similar function may be installed in lieu of firestop systems.
   4. Do not remove forming materials unless specified in system designs.

D. **Firestop sealant:** Seal perimeters, voids and joints of fire-rated walls and partitions, including abutment of floor and roof or ceiling structure, and flutes of metal decking.
   1. If required by UL Design, install mineral wool or ceramic fiber in cavities, packed full and tight with allowance for sealant installation.
   2. Seal both faces of walls and partitions with firestop sealant. Tool sealant flush with adjacent finish.
   3. In accord with UL Fire Resistance Directory Designs, packed concrete and masonry joints shall be sealed using firestop sealant or using sealant as specified in Joint Sealants section.

E. **Mineral fiber safing:**
   1. Install safing in cavities of penetrations through non-rated floor and wall construction, including spaces around piping, conduits, cables and duct penetrations.
   2. Install safing in voids and joints of non-rated walls and partitions abutting metal decking of floor and roof structures. Pack flutes of metal decking solid with safing material.
   3. Safing shall be installed at joints and penetrations in non-rated construction not exposed to view and concealed in finish work. Secure safing by compressing into voids or joints and using manufacturer's standard clips or closure plates as required.

F. **Seal voids and joints of non-rated walls and partitions abutting concrete floor and roof construction using sealant as specified in other sections.**

3.4 **FIELD QUALITY CONTROL**

A. **Inspection:** Independent inspection agency employed and paid by Owner, will examine penetration firestopping in accord with ASTM E2174-10a and ASTM E2393-10a. Inspection agency will examine firestopping and will determine, in general, that firestopping has been installed in compliance with tested and listed firestop system, and that installation process conforms to FM 4991 - Standard for Approval of Firestop Contractors or UL Qualified Firestop Contractor Program.

B. Inspector will advise contractor of deficiencies noted within one working day.

C. Do not proceed to enclose firestopping with other construction until inspection agency has verified firestop installation complies with requirements of Contract Documents.

D. Where deficiencies are found, repair or replace firestopping so that it complies with requirements of tested and listed system design.

3.5 **CLEANING**

A. Clean off excess fill materials and sealants adjacent to openings and joints as work progresses. Use methods and cleaning materials approved by manufacturers of firestopping products and or assemblies in which openings and joints occur.
B. Protect firestopping during and after curing period from contact with contaminating substances.

APPENDIX – SCHEDULE OF SUBMITTALS

<table>
<thead>
<tr>
<th>Submittal Number</th>
<th>Item Number</th>
<th>Description</th>
<th>Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td>07 8400</td>
<td></td>
<td>Firestopping</td>
<td></td>
</tr>
<tr>
<td></td>
<td>078400-1.4-A-01</td>
<td>Product Data &amp; Test Reports – Firestop Systems</td>
<td></td>
</tr>
<tr>
<td></td>
<td>078400-1.4-A-02</td>
<td>Product Data &amp; Test Reports – Firestop Devices</td>
<td></td>
</tr>
<tr>
<td></td>
<td>078400-1.4-A-03</td>
<td>Product Data &amp; Test Reports – Firestop Sealants</td>
<td></td>
</tr>
<tr>
<td></td>
<td>078400-1.4-A-04</td>
<td>Product Data &amp; Test Reports – Safing</td>
<td></td>
</tr>
<tr>
<td></td>
<td>078400-1.4-C-01</td>
<td>Certificates of Compliance</td>
<td></td>
</tr>
</tbody>
</table>

END OF SECTION
PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Joint backup materials.
   2. Joint sealers.

B. Related Sections:
   1. Window framing internal sealants.
   2. Glazing sealants.
   3. Roofing and flashing sealants.
   4. Firestopping.

1.2 REFERENCES

A. ASTM International (ASTM):

1.3 SUBMITTALS

A. Product Data: Indicate sealers, primers, backup materials, bond breakers, and accessories proposed for use. Mark manufacturer’s brochures to include only those products proposed for use.

B. Samples:
   1. 1/2 x 1/2 x 3 inch long joint sealer samples showing available colors.
   2. 6 inch long joint backup material samples.

C. Warranty: Sample warranty form.

1.4 QUALITY ASSURANCE

A. Applicator Qualifications: Minimum 5 years experience in work of this Section.

B. Laboratory Pre-Construction Testing:
   1. Obtain representative samples of actual substrate materials.
   2. Test sealers and accessories for following:
b. Compatibility: Test to ASTM C1087; determine that materials in contact with sealers do not adversely affect sealant materials or sealant color.

c. Staining: Test to ASTM D2203, ASTM C510, or ASTM C1248; determine that sealants will not stain joint substrates.

d. Pre-construction testing is not required when sealant manufacturer furnishes data acceptable to Architect based on previous testing for materials matching those of this Project.

1.5 PROJECT CONDITIONS

A. Do not apply sealers at temperatures below 40 degrees F unless approved by sealer manufacturer.

1.6 WARRANTIES

A. Furnish manufacturer’s 10 year warranty providing coverage for sealers and accessories that fail to provide air and water tight seal, exhibit loss of adhesion or cohesion, or do not cure.

B. Warranties shall begin at Date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Acceptable Manufacturers:
   1. BASF Building Systems. (www.buildingsystems.basf.com)
   2. Dow Corning Corp. (www.dowcorning.com)
   3. GE Silicones. (www.siliconeforbuilding.com)
   4. Pecora Corp. (www.pecora.com)
   5. Sika Corp. (www.sikausa.com)
   6. Tremco, Inc. (www.tremcosealants.com)
   7. Bostik, Inc.
   8. Franklin International

B. Substitutions: Under provisions of Division 01.

2.2 MATERIALS

A. Joint Sealer Type 1:
   1. ASTM C920, Grade P or NS, multiple component polyurethane type, self-leveling for flat surfaces and non-sag for sloped surfaces.
   2. Movement capability: Plus or minus 50 percent.
   3. Color: To be selected from manufacturer’s full color range.
   4. Acceptable products:

B. Joint Sealer Type 2a:
   1. ASTM C920, Type S, Grade NS, single component low modulus silicone type, nonstaining, non sag.
   2. Movement capability: Plus or minus 50 percent.
   3. Color: To be selected from manufacturer's full color range.
   4. Acceptable products:
      a. Dow Corning Corp., #790
      b. Percora Corp., #890
C. Joint Sealer Type 2b:
1. ASTM C920, Type S, Grade NS, single component medium modulus silicone type, nonstaining, non sag.
2. Movement capability: Plus or minus 50 percent.
3. Color: To be selected from manufacturer's full color range.
4. Acceptable products:
   a. Dow Corning Corp., #795
   b. Percora Corp., #895

D. Joint Sealer Type 2c:
1. ASTM C920, single component, neutral-cure silicone silicone type, nonstaining, non sag, non-bleed weathersealing performance.
2. Movement capability: Plus or minus 50 percent.
3. Color: To be selected from manufacturer's full color range.
4. Acceptable products:
   a. Dow Corning Corp., #756 SMS
   b. BASF Building Systems, Sonolastic 150

E. Joint Sealer Type 3:
1. ASTM C1311, Formulated from a blend of butyl rubber and polyisobutylene.
2. Color: To be selected from manufacturer's full color range.
3. Acceptable products:
   a. Bostik, Inc.; Chem-Calk 300
   b. Percora Corporation; BC-158
   c. Tremco Incorporated; Tremco Butyl Sealant.

F. Joint Sealer Type 4:
1. ASTM C834, single component acrylic latex, non sag.
4. Acceptable products:
   a. BASF Building Systems, Sonolastic Sonolac
   b. Bostic, Chem-Calk Painter’s Calk
   c. Franklin International, Titebond Painters Caulk
   d. Percora Corp., AC-20 Acrylic Latex
   e. Tremco, Inc., Tremflex 834.

G. Joint Sealer Type 5:
1. ASTM C920, Grade NS, single component silicone, non sag, mildew and stain resistant.
3. Color: To be selected from manufacturer's full color range.
4. Acceptable products:
   a. Dow Corning Corp., 786 Mildew-Resistant Silicone Sealant
   b. Franklin International, Titebond Kitchen & Bath Sealant
   c. Percora Corp., #898 Silicone Sanitary Sealant.

H. Joint Sealer Type 6 (NOT USED)

I. Joint Sealer Type 7:
1. ASTM C834, single component acrylic latex, non sag, non-hardening, non-corrosive, recommended by manufacturer for acoustical applications.
2. Movement capability: Plus or minus 7-1/2 percent.

2.3 ACCESSORIES

A. Primers, Bondbreakers, and Solvents: As recommended by sealer manufacturer.

B. Joint Backing:
   1. ASTM C1330, closed cell polyethylene foam, preformed round joint filler, non absorbing, non staining, resilient, compatible with sealer and primer, recommended by sealer manufacturer for each sealer type.
   2. Size: Minimum 1.25 times joint width.

2.4 MIXES

A. Mix multiple component sealers in accordance with manufacturer's instructions.
   1. Mix with mechanical mixer; prevent air entrainment and overheating.
   2. Continue mixing until color is uniform.

PART 3 - EXECUTION

3.1 PREPARATION

A. Remove loose and foreign matter that could impair adhesion. If surface has been subject to chemical contamination, contact sealer manufacturer for recommendation.

B. Clean and prime joints in accordance with manufacturer's instructions.

C. Protect adjacent surfaces with masking tape or protective coverings.

D. Sealer Dimensions:
   1. Minimum joint size: 1/4 x 1/4 inch.
   2. Joints 1/4 to 1/2 inch wide: Depth equal to width.
   3. Joints over 1/2 inch wide: Depth equal to one half of width.

3.2 APPLICATION

A. Apply products in accordance with manufacturer's instructions.

B. Install sealers and accessories in accordance with ASTM C1193.

C. Install acoustical sealers and accessories in accordance with ASTM C919.

D. Install joint backing to maintain required sealer dimensions. Compress backing approximately 25 percent without puncturing skin. Do not twist or stretch.

E. Use bondbreaker tape where joint backing is not installed.

F. Fill joints full without air pockets, embedded materials, ridges, and sags.

G. Tool sealer to smooth profile.

H. Apply sealer within manufacturer’s recommended temperature range.

3.3 CLEANING

A. Remove masking tape and protective coverings after sealer has cured.
B. Clean adjacent surfaces.

3.4 SCHEDULE

<table>
<thead>
<tr>
<th>JOINT LOCATION OR TYPE</th>
<th>SEALER TYPE</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Exterior Joints:</strong></td>
<td></td>
</tr>
<tr>
<td>Joints in horizontal surfaces subject to pedestrian traffic</td>
<td>1</td>
</tr>
<tr>
<td>Joints in masonry (including control joints), vertical expansion joints</td>
<td>2a</td>
</tr>
<tr>
<td>Joints in metal panels, perimeter of aluminum framing systems,</td>
<td>2b</td>
</tr>
<tr>
<td>perimeter of hollow metal framing, between wall finish and conduit and pipe penetrations,</td>
<td></td>
</tr>
<tr>
<td>base plates of light fixtures, signage supports, and other items applied to exterior wall surface</td>
<td></td>
</tr>
<tr>
<td>Joints in contact with waterproofing.</td>
<td>2c</td>
</tr>
<tr>
<td>Under thresholds</td>
<td>3</td>
</tr>
<tr>
<td><strong>Interior Joints:</strong></td>
<td></td>
</tr>
<tr>
<td>Joints in horizontal surfaces subject to pedestrian traffic</td>
<td>1</td>
</tr>
<tr>
<td>Joints in masonry (including control joints), vertical expansion joints</td>
<td>2a</td>
</tr>
<tr>
<td>Joints in metal panels, perimeter of aluminum framing systems,</td>
<td>2b</td>
</tr>
<tr>
<td>perimeter of hollow metal framing</td>
<td></td>
</tr>
<tr>
<td>Joints in contact with waterproofing.</td>
<td>2c</td>
</tr>
<tr>
<td>Joints in toilet rooms &amp; countertops</td>
<td>5</td>
</tr>
<tr>
<td>Joints in acoustical assemblies</td>
<td>7</td>
</tr>
<tr>
<td>Other joints</td>
<td>4</td>
</tr>
</tbody>
</table>
# APPENDIX – SCHEDULE OF SUBMITTALS

<table>
<thead>
<tr>
<th>Submittal Number</th>
<th>Item Number</th>
<th>Description</th>
<th>Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td>07 9200</td>
<td></td>
<td>Joint Sealers</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Submittal</td>
<td></td>
<td></td>
</tr>
<tr>
<td>079200-1.3-A-01</td>
<td>Product Data – Sealant Type 1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>079200-1.3-A-02</td>
<td>Product Data – Sealant Type 2a</td>
<td></td>
<td></td>
</tr>
<tr>
<td>079200-1.3-A-03</td>
<td>Product Data – Sealant Type 2b</td>
<td></td>
<td></td>
</tr>
<tr>
<td>079200-1.3-A-04</td>
<td>Product Data – Sealant Type 2c</td>
<td></td>
<td></td>
</tr>
<tr>
<td>079200-1.3-A-05</td>
<td>Product Data – Sealant Type 3</td>
<td></td>
<td></td>
</tr>
<tr>
<td>079200-1.3-A-06</td>
<td>Product Data – Sealant Type 4</td>
<td></td>
<td></td>
</tr>
<tr>
<td>079200-1.3-A-07</td>
<td>Product Data – Sealant Type 5</td>
<td></td>
<td></td>
</tr>
<tr>
<td>079200-1.3-A-08</td>
<td>Product Data – Sealant Type 7</td>
<td></td>
<td></td>
</tr>
<tr>
<td>079200-1.3-B-01</td>
<td>Samples - Color</td>
<td></td>
<td></td>
</tr>
<tr>
<td>079200-1.3-B-02</td>
<td>Samples – Backup Material</td>
<td>Provide only if requested by Architect</td>
<td></td>
</tr>
<tr>
<td>079200-1.3-C-01</td>
<td>Sample Warranty Form</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Project Close-Out Submittal</td>
<td>Provide at date of material completion</td>
<td></td>
</tr>
<tr>
<td>079200-1.6-A-01</td>
<td>Manufacturer’s Warranty</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

END OF SECTION
SECTION 08 1100
HOLLOW METAL DOORS & FRAMES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Hollow metal steel doors and frames.

B. Related Sections:
   1. Division 01 - Administrative, procedural, and temporary work requirements.
   2. Section 08 1416 – Flush Wood Doors
   3. Section 08 7100 - Door Hardware
   4. Section 08 8000 - Glazing
   5. Section 09 9000 – Painting

1.2 REFERENCES

A. American National Standards Institute (ANSI)/Steel Door Institute (SDI):
   2. A250.4 - Test Procedure and Acceptance Criteria for Physical Endurance for Steel Doors, Frames, Frame Anchors and Hardware Reinforcings.
   3. A250.8 - Recommended Specifications for Standard Steel Doors and Frames.
   5. A250.11 - Recommended Erection Instructions for Steel Frames.

B. ASTM International (ASTM):
   1. A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy Coated (Galvannealed) by the Hot-Dip Process.
   3. A1008/A1008M - Standard Specification for Steel, Sheet, Cold-Rolled, Carbon, Structural, High-Strength Low-Alloy and High-Strength Low-Alloy with Improved Formability.
   5. E413 - Classification for Rating Sound Insulation.


D. Steel Door Institute (SDI) 117 - Manufacturing Tolerances for Standard Steel Doors and Frames.

E. Underwriters Laboratories (UL):
   1. 10B - Standard for Fire Tests of Door Assemblies.
   2. 10C - Standard for Positive Pressure Fire Tests of Door Assemblies.

1.3 SUBMITTALS

A. Shop drawings: Indicate door and frame elevations and sections, materials, gauges and finishes, fabrication and erection details, location of finish hardware by dimension and locations, details of openings and louvers, and fire rating requirements.
B. Product data: Indicate that hollow metal doors and frames comply with specified requirements, including performance criteria. Mark manufacturer's brochures to include only those products proposed for use.

C. Samples: Submit as follows:
1. Door: 1'-0" by 1'-0" corner section showing door construction.
2. Welded frame: 1'-0" by 1'-0" head and jamb corner section showing welded corner construction.
3. Anchors: One of each type.

D. Certification of label construction: For components exceeding Underwriters Laboratories Inc. (UL) tested size limitations, submit UL inspection certificate stating that component construction conforms to UL rating requirements.

1.4 QUALITY ASSURANCE

A. Fabrication standard: Except for more stringent requirements specified, comply with ANSI A250.8-2003(R2008) including performance levels as referenced.

B. Fire door assemblies:
1. Door and frame assemblies in rated walls shall have been tested in accord with NFPA 252 or UL 10C; after 5 minutes into NFPA 252 test, neutral pressure shall have been established at 40" or less above sill.
2. Door and frame assemblies in corridors and smoke barriers shall have a minimum fire rating of 20 minutes and shall have been tested in accord with NFPA 252 or UL 10C without hose stream test. Assemblies shall comply with UL 1784 for draft and smoke control test; leakage may not exceed 3.0 CFM per foot of door at 0.10" of water column.

C. Labeling requirements:
1. Fire-rated components shall bear factory-applied labels showing name of manufacturer, name of third-party inspection agency, fire-protection rating, and where required for doors in exit enclosures, maximum transmitted temperature end point.
2. Smoke and draft doors complying with UL 1784 shall be labeled as a smoke and draft control door.
3. Permanently attach label to hinge stile of each fire-rated and smoke and draft control door.

1.5 DELIVERY, STORAGE AND HANDLING

A. Deliver hollow metal doors and frames cartoned for protection. Mark each hollow metal door and frame at top hinge and on outside of carton with destination door mark indicated on door schedule.

B. Inspect work upon delivery for damage. Reject damaged items.

C. Store materials under cover, on raised platforms.
1. Stack a maximum of five assembled frame units and doors vertically with minimum 1/4" spacers between units.
2. Protect from moisture but provide for cross ventilation. Remove units from wet containers if wetting occurs.

PART 2 - PRODUCTS

2.1 MANUFACTURERS
A. Acceptable Manufacturers:
   1. Ceco Door. (www.cecodoor.com)
   2. Curries. (www.curries.com)
   4. Steelcraft. (www.steelcraft.com)

B. Substitutions: Under provisions of Division 01.

2.2 MATERIALS

A. Steel:
   1. Interior doors and frames: Fabricate of cold-rolled steel sheet meeting ASTM A1008-08a.
   2. Exterior doors and frames: Fabricate of commercial quality, hot dip galvanized or
      galvannealed steel sheet meeting ASTM A653-08 Designation A60 or G60; wipe coat
      not acceptable.

B. Finish: Prime painted steel surfaces shall comply with requirements for acceptance stated in
   ANSI A250.3-2007.
   1. Interior doors and frames: One coat of manufacturer's standard rust-inhibitive primer.
   2. Exterior doors and frames: One coat of manufacturer's standard rust-inhibitive primer
      after chemical treatment of galvanized surfaces for paint adhesion.

C. Coating for inside of frames to be fully grouted in masonry and concrete construction:
   1. Acceptable products:
      a. Tnemec Series 66 Hi-Build Epoxoline.
      b. ICI, Devran 224HS High Build Epoxy.
      c. PPG Aquapon High-Build Semi-Gloss Polyamide-Epoxy Coating 97-130 Series.
      d. Or equal.
   2. Type: Factory or field applied epoxy undercoating.

2.3 DOORS

A. Door classification:
      Two seamless, 1-3/4" thickness.
   2. Label fire-resistive composite metal doors:
      a. Level II, 18 ga., Heavy Duty, Model Two seamless, 1-3/4" thickness, with mineral
         fiberboard core for ratings over 20 minutes.
      b. For fire doors in exit enclosures, average temperature developed on unexposed
         side during fire-resistance testing shall not exceed 450 degrees F at end of 30
         minutes in fire test.
   3. Exterior insulated composite metal doors: Level III, 16 ga., Extra Heavy Duty, Model
      Two seamless, 1-3/4" thickness, with polyurethane core.

B. Door construction:
   1. Edge bevel: Vertical edges beveled 1/8" in 2"; double-acting doors rounded on 2-1/8"
      radius. Non-handed door blanks with filler plates are not acceptable.
   2. Top and bottom edges: Flush, welded, minimum 18 ga. steel. Provide weep holes in
      bottom edge of exterior doors.
   3. Join edges of exterior doors by a continuous weld extending the full height of door.
      Grind, fill and dress welds smooth to make invisible and provide smooth flush surface.
   4. Join edges of interior doors by tack welds no more than 6" on center extending the full
      height of door. Grind, fill and dress tack welds smooth to make them invisible and
      provide a smooth flush surface.
C. Glass moldings and stops:
   1. Where specified or scheduled, provide doors with hollow metal moldings to secure glazing by others in accordance with glass opening sizes shown on approved shop drawings.
   2. Weld fixed moldings to door on security side.
   3. Loose stops shall be not less than 20 gage, with mitered corner joints, secured to frame opening by cadmium- or zinc-coated countersunk screws at 1'-0" o.c. maximum.
   4. Design snap-in moldings with mitered corners and with a non-removable stop on security side after glass installation.

2.4 FRAMES

A. Frame construction including sidelights and borrowed lite frames:
   1. Welded steel frames: 16 ga., with backbend returns.
      a. Setup arc welded, with all joints, including face, flange and throat, full welded, dressed and ground smooth; no mechanical interlocking allowed.
      b. Provide welded frames with temporary spreaders during shipping, storage and erection. Spreaders shall span both rabbets of frame and be located at bottom and at middle of frame.
   2. Transom bars and mullions: Shop fabricate from same material as door frames.
      a. Setup arc welded, with all joints, including face, flange and throat, full welded, dressed and ground smooth; no mechanical interlocking allowed.
      b. Fabricate in largest size sections allowed by shipping and installation restrictions. Field joints shall occur only as indicated on approved shop drawings. **
   3. Machine door frames for hardware scheduled for installation on that frame. Filler plates installed at unused openings will not be acceptable. Provide blockouts behind frame for continuous hinges.
   4. Joints:
      a. Dress welded joints and ground smooth, indistinguishable in completed work.
      b. Make non-welded connections with tight fitting, closed joints.
      c. Make joints with aligned faces and arrises.
   5. Inside of frames to be grouted in masonry and concrete construction shall receive protective coating as specified herein.
   6. Loose glazing stops:
      a. Removable glazing stops shall be cold rolled steel, no less than 20 gage, butted at corner joints and secured to frame using cadmium or zinc plated #6 countersunk sheet metal screws at 1'-0" o.c. maximum.
      b. Frame underneath glazing stops and inside of glazing stop shall be treated for maximum paint adhesion and shall receive factory spray-applied high-build epoxy coating specified herein, 4 to 6 mils dft., prior to installation in frame.
   7. Coordinate and prep frames for access control hardware where indicated.

B. Frame anchors:
   1. Wall anchors for frame attachment to masonry construction: Adjustable, flat, minimum 18 gage corrugated or perforated, T-shaped steel anchors with leg not less than 2" wide by 10" long. Provide one anchor per jamb for each 2'-0" of height or fraction thereof. Anchors for fire-rated frames shall be labeled type.
   2. Wall anchors for frame attachment to drywall partitions: Manufacturer's standard adjustable type for attachment to studs. Provide one anchor per jamb for each 2'-0" of height or fraction thereof. Anchors for fire-rated frames shall be labeled type.
   3. Floor anchors: Provide frames, other than slip-on drywall type, with minimum 18 gage anchors for attachment to floor.
      a. For wall conditions that do not allow for the use of a floor anchor, provide an additional jamb anchor.
b. Anchors for fire-rated frames shall be labeled type.

4. Head struts: For frames over 7'-0" high and not anchored to masonry or concrete construction, provide 1/4" by 2" steel struts spot welded to jambs, each side, extending to building structure. Attach to structure. For frames over 4'-0" in width, provide center strut at head.

2.5 ACCESSORIES

A. Astragals: Mortised, 12 ga. material. Fire-rated "B" and "C" labeled doors shall be of type not requiring astragals to obtain rating.

B. Louvers: Inverted "Y" type; sightproof, 20 ga. blades, welded in 18 ga. frame; providing not less than 30 percent free air movement.

2.6 PREPARATION FOR HARDWARE AND ANCHORS

A. Reinforcement: Factory reinforce door and frame components for hardware installation in accord with ANSI A250.8-2003(R2008) and ANSI A250.6-2003.

B. Punch single leaf frames to receive three silencers; double leaf frames to receive two silencers per leaf, at head.

C. Provide grout shields where frames in masonry walls are cut or drilled.

D. Install hardware reinforcement and anchors without distortions or blemishes on exposed surfaces.

2.7 DESIGN CLEARANCES

A. Between door and frame: Maximum 1/8 inch.

B. Between meeting edges of pairs of doors:
   1. Non-fire rated doors: 3/16 inch plus or minus 1/16 inch.
   2. Fire-rated doors: 1/8 inch plus or minus 1/16 inch.

C. Undercut:
   2. Fire-rated doors: Comply with NFPA 80.

D. Between face of door and stop: 1/16 to 3/32 inch.

2.8 FINISHES

A. Dress tool marks and surface imperfections to smooth surfaces.

B. Clean and chemically treat steel surfaces.

C. Touch up damaged metallic coatings.

D. Apply manufacturer's standard rust inhibiting primer paint, air-dried or baked on, meeting requirements of ANSI/SDI A250.10.

PART 3 - EXECUTION

3.1 FRAME INSTALLATION
A. General:
2. Frames in masonry and concrete walls and fire-rated frames shall be tightly butted to walls. For other frames, clearance between frame and interfacing wall surfaces shall be 1/16” maximum.
3. Shimming of door hinges is not an acceptable correction of door frames installed out of erection tolerance.

B. Welded frames:
1. Set welded frames in position prior to beginning partition work. Brace frames until permanent anchors are set.
2. Set anchors for frames as work progresses. Install anchors at hinge and strike levels. Install rubber bumpers and silencers in frames prior to grouting.
3. Grout frames in masonry walls as specified in Concrete Unit Masonry section.
4. Remove temporary spreaders before frame installation is complete.
5. Remove temporary braces after wall construction is complete.
6. Install welded frames in prepared openings in concrete and masonry walls using countersunk bolts and expansion shields.
7. Weld field splices in borrowed lite frames and grind smooth.

C. Fire-rated frames: Install in accord with requirements of NFPA No. 80 and ANSI A250.11-2001.

3.2 DOOR INSTALLATION

A. General:
1. Install doors in accord with SDI-122-07, ANSI A250.8-2003(R2008), manufacturer’s product data and approved shop drawings.
3. Install hollow metal doors in frames, using hardware specified in Door Hardware section.
4. Shimming of door hinges is not an acceptable repair of warped doors or door frames out of erection tolerances.

B. Edge clearances at doors:
1. Between door and frame, at head and jambs: 1/8”.
2. At meeting edges of pairs of doors and at mullions: 1/8” to 1/4” (1/8” for fire rated doors).
3. At transom panels, without transom bars: 1/8”.
4. At sills without thresholds: 3/8” maximum above finish floor.
5. At sills with thresholds: 3/8” maximum above top of threshold.
6. Between face of door and door stop: 1/16”.

C. Fire-rated doors: Install in accord with requirements of NFPA No. 80, SDI-118-05 and ANSI A250.11-2001.

3.3 SITE TOLERANCES

A. Allowable erection tolerances:
1. Variation from specified clearances: +1/32”.
2. Variation in face alignment, pairs of doors: +1/16”.
3. Variation in face alignment between door and frame: 1/8” maximum.

3.4 CLEANING AND PROTECTION
A. Protect hollow metal doors and frames from damage and staining until Date of Substantial Completion. Replace or repair damaged or stained components.

B. Replace components which exhibit warp, buckle or broken welds.

APPENDIX – SCHEDULE OF SUBMITTALS

<table>
<thead>
<tr>
<th>Submittal Number</th>
<th>Item Number</th>
<th>Description</th>
<th>Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td>08 1100</td>
<td></td>
<td>Submittal</td>
<td></td>
</tr>
<tr>
<td></td>
<td>081100-1.3-A-01</td>
<td>Shop Drawings</td>
<td></td>
</tr>
<tr>
<td></td>
<td>081100-1.3-B-01</td>
<td>Product Data – H.M. Doors</td>
<td></td>
</tr>
<tr>
<td></td>
<td>081100-1.3-B-02</td>
<td>Product Data – H.M. Frames</td>
<td></td>
</tr>
<tr>
<td></td>
<td>081100-1.3-B-03</td>
<td>Product Data – Anchors</td>
<td></td>
</tr>
<tr>
<td></td>
<td>081100-1.3-C-01</td>
<td>Samples – H.M. Doors</td>
<td>Requested by Architect only if not providing basis of design items</td>
</tr>
<tr>
<td></td>
<td>081100-1.3-C-02</td>
<td>Samples – H.M. Frames</td>
<td>Requested by Architect only if not providing basis of design items</td>
</tr>
<tr>
<td></td>
<td>081100-1.3-C-03</td>
<td>Samples – Anchors</td>
<td>Requested by Architect only if not providing basis of design items</td>
</tr>
<tr>
<td></td>
<td>081100-1.3-D-01</td>
<td>Certification of Label</td>
<td></td>
</tr>
</tbody>
</table>

END OF SECTION
SECTION 08 1416
FLUSH WOOD DOORS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Wood veneer faced flush doors.
   2. Factory finishing.

B. Related Sections:
   1. Division 01 - Administrative, procedural, and temporary work requirements.
   2. Section 08 1113 - Hollow Metal Frames
   3. Section 08 7100 - Door Hardware
   4. Section 09 9000 – Painting

1.2 REFERENCES

A. Applicable standards; as referenced herein:
   2. ASTM International (ASTM).
   4. Hardwood Plywood and Veneer Association (HPVA).
   7. Warnock-Hersey (WH).
   8. Window and Door Manufacturers Association (WDMA).

1.3 SUBMITTALS

A. Shop drawings: Submit schedules and elevations indicating door sizes, construction, swing, fire rating, undercut, and hardware locations. Dimension and detail openings for glass lites. Indicate that doors meet specified requirements, including fire ratings.

B. Product data: Submit manufacturer's product description, indicating materials, classifications, factory finish and fabrication. Include manufacturer's proposed warranty. Indicate that doors meet specified requirements, including fire ratings. Include manufacturer's requirements for door installation, care, maintenance and cleaning to obtain specified warranties. Mark manufacturer's brochures to include only those products proposed for use.

C. Samples:
   1. Submit 4" by 4" door corner samples indicating construction for each door type.
   2. Submit sets that include a minimum of 3 samples of each face veneer in each set, 8" by 8" in size, representative of proposed species, cut, color and grain, finished with proposed factory finish. Accepted samples shall indicate extremes of color, graining, defects and general quality of proposed veneers.

D. Intent to warrant and certifications: Submit an Intent to Warrant executed by authorized representative of door manufacturer, indicating that manufacturer has reviewed drawings and specifications, conditions affecting the work and the relationship of doors with related work, and that manufacturer proposes to provide warranties as referenced herein without further stipulation.
1.4 QUALITY ASSURANCE

A. Allowable color and grain variation of natural finished doors: Color and grain shall be uniform and within range established by accepted veneer samples as specified herein. Joints in face veneers shall be inconspicuous. Adjacent doors and doors viewed together shall have similar color and grain.

B. Fire door assemblies:
   1. Door assemblies in rated walls shall have been tested in accord with NFPA 252 or UL 10C.
   2. Door assemblies in corridors and smoke barriers shall have a minimum fire rating of 20 minutes and shall have been tested in accord with NFPA 252 or UL 10C without hose stream test. Assemblies shall comply with UL 1784 for draft and smoke control test; leakage may not exceed 3.0 CFM per foot of door at 0.10” of water column.
   3. Fire-rated doors shall provide rating without use of salt-treated wood, or manufacturer shall provide certification that treated wood is non-hygrosopic and shall warrant door against failure or discoloration of face veneer and door finish.
   4. For fire doors in exit enclosures the average temperature developed on unexposed side during fire-resistance testing shall not exceed 450 degrees F. at the end of 30 minutes in fire test.

C. Labeling requirements:
   1. On top edge, provide each door with a label which identifies manufacturer, trade association of which he is a member, grade and type of door or industry standard with which it complies.
   2. Fire-rated components shall bear factory-applied labels showing manufacturer’s name, name of third-party inspection agency, fire-protection rating, and where required for doors in exit enclosures, maximum transmitted temperature end point. Permanently attach label to hinge stile of each fire-rated door.
   3. Smoke and draft doors complying with UL 1784 shall be labeled as a smoke and draft control door.

D. Flush doors shall be the product of one manufacturer.

E. Face veneers shall be domestically assembled veneer facing using no rainforest-produced crossbands or backs.

F. Pre-installation meeting: Prior to beginning door installation work, a pre-installation meeting shall be held to review work to be accomplished.
   1. Contractor, Architect, door manufacturer’s representatives, and other subcontractors who have equipment relating to doors shall be present.
   2. Contractor shall notify all parties at least seven days prior to time for meeting.
   3. Contractor shall record minutes of meeting and distribute to attending parties.

1.5 DELIVERY, STORAGE AND HANDLING

A. Deliver no doors to building until weatherproof storage space is available. Store doors in a space having controlled temperature and humidity. Stack doors flat, off floor, supported to prevent warpage and protected from damage and direct exposure to sunlight.

B. Seal top and bottom edges of doors.

C. Protection for shop-finished doors: Protect doors during shipping and storage by enclosing in polyethylene bags. Replace doors in original packaging for shipment to site following machining and finishing. Hang pre-machined and prefinished doors without removal of packaging. Identify each door with door number on packaging. Maintain packaging in place until Date of Material Completion.
D. Break packaging seal on site to permit ventilation.

E. Do not walk or stack other materials on top of stacked doors. Do not drag doors across each other.

1.6 WARRANTIES

A. Provide manufacturer's door replacement warranty against warpage, twist, delamination, telegraphing of core and manufacturing defects for the following terms:
   1. Interior solid core and mineral core doors: Lifetime of original installation.
   2. Door finish for rated doors: Five years against discoloration or failure of factory finish approved field finish of fire-rated mineral core doors with salt-treated wood components.

B. Warranties commence at Date of Material Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Acceptable Manufacturers:
   1. Algoma Hardwoods, Inc. (www.algomahardwoods.com)
   2. Eggers Industries. (www.eggersindustries.com)
   4. Oshkosh Door Co. (www.oshkoshdoor.com)
   5. VT Industries, Inc. (www.vtindustries.com)

2.2 MATERIALS

A. General quality standard: AWI, Section 1300, Custom Grade.

B. Glued particleboard core wood doors:
   1. Description: Meeting AWI Standards, Section 1300, five-ply veneer face construction, AWI PC5, or particleboard core.
      a. Description: Meeting AWI Standards, Section 1300, five-ply veneer face construction, AWI PC5, or particleboard core.
      b. Thickness: 1-3/4".
      c. Adhesive bond:
         1) Type II or better for interior non-rated applications; Type I for rated applications.
         2) Adhesives shall not contain urea formaldehyde.
      d. Blocking: Top and bottom rail and lock stile blocking shall accommodate specified hardware, without through-bolting hardware.
      e. Top rail for doors indicated to receive closers: Provide 12" high top rail for doors scheduled to receive closers. Top rail shall accommodate specified hardware without through-bolting hardware.
   2. Particleboard core: Agrifiber-based particleboard complying with ANSI A208.1, Grade LD-2 or M-2, except for density.
   3. Construction: Solid hardwood, engineered laminated hardwood or structural composite lumber stiles and rails glued to core; core assembly sanded for uniform thickness.
   4. Crossbanding: Engineered high density fiberboard (HDF), minimum 1/16" thickness.
   5. Fire resistance rating: Comply with specified requirements for tested, labeled door construction for ratings indicated on drawings.

C. Fire-rated mineral core doors:
   1. Description: Five-ply non-combustible mineral composition core construction, meeting
AWI Standards, Section 1300, FD Series and label requirements scheduled on drawings.

2. Core: Single piece, non-combustible, asbestos-free, mineral composite with minimum 24 pcf density when tested in accord with ASTM C303-07, with 10 percent maximum moisture absorption by weight with core in equilibrium at 90 percent relative humidity and 70 degrees F.

3. Construction: Stiles, rails and blocking glued to core; core assembly sanded for uniform thickness. Stiles, rails and blocking shall be non-combustible composition, to receive full mortise hinge installation, with the following minimum characteristics:
   a. Screw withdrawal resistance: 600 lbs. minimum when tested in accord with ASTM D1037-06a.
   c. Blocking: Top and bottom rail and lock stile blocking to accommodate specified hardware, meeting label requirements scheduled.

4. Crossbanding: Engineered high density fiberboard (HDF), minimum 1/16" thickness. Crossbanding shall be non-salt-treated or door finish shall be warranted by door manufacturer against failure or discoloration.

5. Fire resistance rating: Comply with specified requirements for tested, labeled door construction for ratings indicated on drawings.

6. Where rated door pairs require metal astragal for labeled construction, astragals shall be wrapped in veneer matching door face or concealed within door edge.

7. Applied moldings: Moldings, where indicated on drawings, shall be applied by the manufacturer in accord with tested label requirements.

D. Facing veneer for transparent finish:
   2. Veneer slicing: Plain sliced panels with book matched veneers center matched across door width.
   3. Veneer thickness: Minimum 1/52" after sanding at 12% moisture content.
   4. Adhesive bond: Type I, containing no urea formaldehyde.
   5. Doors in pairs or sets: Pair match veneers at meeting stiles for doors hung in pairs.

E. Vertical stiles:
   1. Stiles for transparent finish doors not requiring fire ratings: Minimum 1-3/8" wide by thickness of core with specified veneer, solid hardwood or structural composite lumber inner stile backer with edge veneer matching face veneer in specie, color and graining; no exposed fingerjoints allowed.
   2. Stiles for fire-rated doors: Minimum 1-3/8" wide by thickness of core with specified veneer, solid hardwood or lamination meeting fire rating requirements; edge veneer matching face veneer.
      a. 20-minute rated pairs without metal edges or astragals: As required by manufacturer to permit positive pressure AS@ label per Category H; veneer banded to match face veneer over manufacturer's edge for improved screw holding.
      b. Mineral core doors required to meet positive pressure Category A (concealed) requirements: As required by door manufacturer.
      c. Pairs of fire-rated doors:
         1) With metal edges or metal edges and astragals: As required by door manufacturer's test data for required fire-ratings.
         2) Without metal edges or metal edges and astragals: As required by door manufacturer's test data for required fire-ratings.
         3) For 20 minute doors: Treated stiles at meeting edge.
         4) Mineral core doors required to meet positive pressure or B (frame
mounted intumescent) requirements: As required by door manufacturer.

3. Stile width for doors with cutouts:
   a. Non-rated doors: Provide minimum 5" of core between lock and light cutout or from edge of door to edge of cutout.
   b. Rated doors: Provide minimum 5-1/2" core between lock and cutout or from edge of door and edge of cutout.
   c. Opening next to lock: Provide minimum 10" lock stile.

F. Rails: Mill option hardwood or structural composite lumber and as required to meet positive pressure ratings.

G. Moldings, louvers and trim:
   1. Furnish in same species as hardwood matching grain and color of face veneer for transparent finish, no fingerjoints allowed.
   3. Moldings for fire-rated doors: Manufacturer’s standard matching solid hardwood, laminated wood or primed steel edge meeting fire-rating requirements.
   4. Provide moldings for glass lites and recessed-mounted metal grilles.
   5. Louvers: Round edge, recessed design.

2.3 GLAZING

A. Glass and Glazing Accessories: Specified in Section 08 8000.

2.4 FACTORY FITTING, MACHINING AND FINISHING

A. Factory fitting and machining are required for all wood doors. Factory finishing is required for all transparent finished doors.

B. Fitting and machining:
   1. Factory fit and machine doors to clearances and bevels specified.
   2. Prepare for hardware installation using hardware manufacturer's templates.
      a. Locate in accord with WDMA I. S. 1.7, unless otherwise indicated.
      b. Drill pilot holes for screws and bolts.
      c. Coordinate and prep for access control hardware where indicated.
   3. Seal edges of doors and cutouts immediately following fitting and machining.

C. Openings:
   1. Cut openings to receive grilles and glass lites in accord with AWI requirements or WDMA I. S. 1-A.
   2. Seal edges of cutout immediately following cutting using one coat of solvent type sealer.
   3. Install glass lites without looseness or rattle. Trim shall have mitered corner joints and shall conceal edges of cutout and door core.
   4. Protect door faces from damage during cutting.
   5. Prepare and glaze openings in fire-rated doors in accord with NFPA and UL requirements.

D. Clearances and bevel:
   1. Hinge stile: 1/8”.
   2. Lock stile: 1/8”.
   3. Top: 1/8”.
   4. Bottom: 1/4” above floor finish or threshold, except where undercutting is indicated.
      Confirm installed floor covering thickness before cutting door bottom edges.
   5. Meeting stiles, pairs of doors: 1/8”.
   6. Bevel: 1/8” in 2".
E. Sanding: Factory sand doors to comply with AWI Standards, Section 1300 for flush doors.

F. Factory finish:
   1. Type: AWI Standards, Section 1500, Custom Grade System, Conversion Varnish or Catalyzed Polyurethane, filled finish. Color and sheen to match Architect's sample.
   2. Finish faces and edges of doors, including mortises and cutouts.

2.5 SOURCE QUALITY CONTROL

A. Fabrication tolerances:
   1. Overall dimension: +/- 1/16".
   2. Width: +1/32".
   3. Maximum warp, bow, cup or twist: 1/4".
   4. Squareness: Maximum 1/8" difference in diagonal measurement.
   5. Hardware locations: -0", +1/32".

PART 3 - EXECUTION

3.1 INSTALLATION

A. Acclimatization: Allow doors to become acclimated to finished space conditions a minimum of 72 hours before hanging.

B. Preparation: Verify that framed openings are installed within specified tolerances. Do not install doors in frames which are not installed within size and plumbness tolerances.

C. Installation:
   1. Install doors in accord with manufacturer's product data using scheduled hardware.
      Install using threaded-to-the-head wood screws furnished by hardware manufacturer.
   2. Anchor hardware in correct position and alignment.
   3. Adjust hardware and door for proper function and for smooth, free operation, latching without force or excess clearance, within specified clearances and tolerances.

D. Fire-rated doors: Install in accord with UL requirements and NFPA No. 80-92 and No. 105-93.

E. Erection tolerances:
   1. Variation from specified clearances: +1/32", -0.
   2. Maximum variation in edge alignment, pairs of doors: 1/16".

F. Replace doors with defects in material, finish, fit or machining.
## APPENDIX – SCHEDULE OF SUBMITTALS

<table>
<thead>
<tr>
<th>Submittal Number</th>
<th>Item Number</th>
<th>Description</th>
<th>Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td>08 1416</td>
<td></td>
<td>Flush Wood Doors</td>
<td></td>
</tr>
<tr>
<td></td>
<td>081416-1.3-A-01</td>
<td>Shop Drawings – Flush Wood Doors</td>
<td></td>
</tr>
<tr>
<td></td>
<td>081416-1.3-B-01</td>
<td>Product Data – Flush Wood Doors</td>
<td></td>
</tr>
<tr>
<td></td>
<td>081416-1.3-C-01</td>
<td>Samples – Door Corner</td>
<td>Requested by Architect only if not providing basis of design items</td>
</tr>
<tr>
<td></td>
<td>081416-1.3-C-02</td>
<td>Samples – Face Veneer</td>
<td></td>
</tr>
<tr>
<td></td>
<td>081416-1.3-D-01</td>
<td>Intent to Warrant</td>
<td></td>
</tr>
<tr>
<td></td>
<td>081416-1.6-A-01</td>
<td>Manufacturer’s Warranty</td>
<td></td>
</tr>
</tbody>
</table>

**Project Close-Out Submittals**

Provide at date of material completion

END OF SECTION
SECTION 08 3100
ACCESS DOORS & PANELS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Access doors and frames for wall and ceiling surfaces.

B. Related Sections:
   1. Division 01 - Administrative, procedural, and temporary work requirements.
   2. Section 09 2900 – Gypsum Board Assemblies
   3. Section 09 9000 – Painting
   4. Division 22 – Plumbing
   5. Division 23 – Heating, Ventilating & Air Conditioning
   6. Division 26 – Electrical
   7. Division 27 – Communications

1.2 REFERENCES

A. ASTM International (ASTM):
   1. A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.


C. Underwriters Laboratories (UL) 10B - Standard for Fire Tests of Door Assemblies.

1.3 SUBMITTALS

A. Product data: Indicate material types, finishes and sizes, fabrication and installation details and requirements. Mark manufacturer's brochures to include only those products proposed for use.

1.4 QUALITY ASSURANCE

A. Labeling requirements:
   1. Fire-rated access door assemblies shall bear factory-applied labels showing name of manufacturer, name of third-party inspection agency, fire-protection rating, and where required for access doors in exit enclosures, maximum transmitted temperature end point.
   2. Horizontal access doors shall bear a label that includes the wording “FOR HORIZONTAL INSTALLATION”.
   3. Permanently attach label to each door and frame.

1.5 DELIVERY, STORAGE AND HANDLING

A. Deliver access doors in protective packaging.

B. Store in packaging to prevent soiling and physical damage.

C. Handle to prevent damage to finished surfaces and operating mechanisms.
1.6 PROJECT/SITE CONDITIONS

A. Protection: Protect prefinished surfaces from damage or staining. Following installation, provide protective covering for duration of project.

B. Coordinate installation of access doors required to be built into building structure. Secure templates or lay out to rough dimensions provided by specialty manufacturer.

PART 2 - PRODUCTS

2.1 ACCESS DOORS & PANELS

A. Acceptable manufacturers; subject to compliance with specified requirements:
   1. Acudor Products, Inc.
   2. Babcock Davis Hatchways.
   3. J. L. Industries, Inc.

B. Characteristics:
   1. Size: Minimum 2'-0" by 2'-0", unless indicated otherwise on drawings, but in no case smaller than 1'-0" by 1'-0".
   2. Types:
      a. Typical: As required by substrates.
      b. Non-fire-rated access doors in gypsum board work: Flush type with perforated frame flanges for finishing with joint compound.
   3. Construction:
      a. Non-fire-rated units: Minimum 14 ga. steel sheet for doors; 16 ga. for frames; prime painted.
      b. Fire-rated units: Minimum 22 ga. steel inside and outside faces; box construction, filled with insulation; 16 ga. frames; prime painted.
   4. Hardware:
      a. Non-fire-rated units: Manufacturer's standard concealed hinges allowing 175 degree operation and cylinder lock. Provide two keys per lock.
      b. Fire-rated panels: Manufacturer's standard continuous piano hinges, self-closing mechanism, interior release and cylinder lock. Provide two keys per lock.
      c. Key all panels alike.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install access doors in accord with manufacturer's product data, plumb, level and true to line and location.

B. Install access doors with fasteners of type and spacing recommended by manufacturer's product data.

C. Set fire rated access doors at locations and elevations indicated and in accord with NFPA 80.

D. Protect surfaces from damage or staining. Clean surfaces prior to Date of Substantial Completion.

E. Test and adjust hardware for ease of operation.

F. Field paint access doors and panels in accord with requirements of Painting and Coating section. Colors shall match adjacent surface.
### APPENDIX – SCHEDULE OF SUBMITTALS

<table>
<thead>
<tr>
<th>Submittal Number</th>
<th>Item Number</th>
<th>Description</th>
<th>Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td>08 3100</td>
<td></td>
<td>Access Doors &amp; Panels</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Submittal</td>
<td></td>
</tr>
<tr>
<td>083100-1.3-A-01</td>
<td></td>
<td>Product Data – Access Doors &amp; Panels</td>
<td></td>
</tr>
</tbody>
</table>

END OF SECTION
PART 1 - GENERAL

1.1 SUMMARY:

A. Work of this section includes sliding barn doors, tracks, and hardware. Locking devices are included in another section.

B. Related Sections:
   1. Division 01 - Administrative, procedural, and temporary work requirements.
   2. Section 08 7100 – Door Hardware.

1.2 SUBMITTALS:

A. Submit manufacturer’s shop drawings, including plans, elevations, sections, and details, indicating dimensions, tolerances, materials, components, hardware, finish, options, and accessories. Shop drawings to show blocking by others.

B. Product data: Submit manufacturer’s product literature and installation instructions. Mark manufacturer’s brochures to include only those products proposed for use.

C. Finish samples: Submit minimum 3" by 3" sample of final door finish.

1.3 QUALITY ASSURANCE:

A. Applicable standards; comply with the following as referenced herein: ASTM International (ASTM).

1.4 DELIVERY, STORAGE AND HANDLING:

A. Deliver materials to project site in manufacturer’s original packaging or containers with labels clearly identifying product name and manufacturer.

B. Storage and Handling Requirements:
   1. Store and handle materials in accordance with manufacturer’s instructions.
   2. Keep materials in manufacturer’s original, unopened containers and packaging until installation
   3. Store materials in clean, dry area indoors.
   4. Protect materials and finish during storage, handling, and installation to prevent damage.

1.5 WARRANTIES:

A. Manufacturer shall warrant that sliding barn doors will be free from defects in material and workmanship for two (2) years.
   1. Warranty period shall commence at the date of substantial completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS:

A. Acceptable manufacturers:
   2. Artisan Hardware (www.artisan hardware.com).

B. Substitutions: Under provisions of Division 01.

2.2 MATERIALS:

A. Sliding Barn Doors:
   1. Basis of design: Weathered Horizontal Plank Barn Door
   2. Thickness: 1-3/4”.
   3. Door Width: 4'-0" or 6'-0" as indicated on the drawings.
   4. Door Height: 9'-0".
   5. Factory assembled / factory finished.

2.3 ACCESSORIES:

A. Track:
   1. Basis of design: Stainless Steel Classic Flat Track Kit.
   3. End Stop: Standard
      a. End tops are required at track midpoint for door pairs to prevent doors from travelling beyond the midpoint.
   4. “Soft Stop” operation.
   5. Track Length:
      a. 8'-0" track length for each 4'-0" door.
      b. 10'-0" track length for each 5'-0" door.

B. Pull Hardware:
   1. Basis of design: Swiss Rod / Flush Pull Set.
      a. 24" Bar Pull / 15" Flush Pull Set.
      b. Finish: Stainless steel.

C. Locking hardware: Specified in 08 7100 Door Hardware.

D. Miscellaneous Hardware:
   1. Bottom guide: C-Guide for 1-3/4” doors
      b. Provide at each door.

PART 3 - EXECUTION

3.1 EXAMINATION:

A. Examine wall openings to receive sliding doors for plumb, level, and square. Note: Finish door operation will be affected by out of tolerance framing.

B. Verify dimensions of wall openings.

C. Examine surfaces to receive top rail and bottom guide.

D. Notify Architect of conditions that would adversely affect installation or subsequent use of sliding doors.

E. Do not begin installation until unacceptable conditions are corrected.

F. Base of door side to be flush or minimal. Rubber Base acceptable.
3.2 INSTALLATION:

A. Install sliding doors in accordance with manufacturer’s instructions at locations indicated on the Drawings.

B. Install sliding doors plumb, level, square, and in proper alignment.

C. Install sliding doors to close against walls without gaps

D. Install sliding doors to open and close smoothly.

E. Anchor sliding doors securely in place to supports. Blocking is required at full width/length of top track.

3.3 ADJUSTING:

A. Adjust sliding doors for proper operation in accordance with manufacturer’s instructions

B. Adjust sliding doors to operate smoothly without binding.

C. Repair minor damages to finish in accordance with manufacturer’s instructions and as approved by Architect

3.4 PROTECTION:

A. Protect installed sliding doors from damage during construction.

APPENDIX – SCHEDULE OF SUBMITTALS

<table>
<thead>
<tr>
<th>Submittal Number</th>
<th>Item Number</th>
<th>Description</th>
<th>Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td>08 3616</td>
<td></td>
<td>Sliding Barn Doors</td>
<td></td>
</tr>
<tr>
<td></td>
<td>083616-1.2-A-01</td>
<td>Shop Drawings</td>
<td></td>
</tr>
<tr>
<td></td>
<td>083616-1.2-B-01</td>
<td>Product Data</td>
<td></td>
</tr>
<tr>
<td></td>
<td>083616-1.2-C-01</td>
<td>Finish Samples</td>
<td>Requested by Architect only if not providing basis of design items</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Project Close-Out Documentation</td>
<td>Provide at date of material completion</td>
</tr>
<tr>
<td></td>
<td>083616-1.5-A-01</td>
<td>Warranty</td>
<td></td>
</tr>
</tbody>
</table>

END OF SECTION
PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Aluminum entrance doors and frames.
   2. Aluminum framed glazed storefronts.
   3. Glass infill panels.
   4. Door hardware.

B. Related Sections:
   1. Division 01 - Administrative, procedural, and temporary work requirements.
   2. Section 07 9200 - Joint Sealers.
   3. Section 08 7100 - Door Hardware.
   4. Section 08 8000 - Glazing.

1.2 REFERENCES

A. American Architectural Manufacturers Association (AAMA):
   1. 611 - Voluntary Specification for Anodized Architectural Aluminum.

B. American National Standards Institute/Builders Hardware Manufacturers Association (ANSI/BHMA) A156.3 - Exit Devices.

C. American Society of Civil Engineers (ASCE) 7 - Minimum Design Loads for Buildings and Other Structures.

D. ASTM International (ASTM):

E. Underwriters Laboratories (UL) 305 - Safety Panic Hardware.

1.3 PERFORMANCE REQUIREMENTS:

A. Design criteria; glazed storefront framing without doors or operable vents:
   1. Design storefront and entrance framing systems to provide for such expansion and contraction of component materials as will be caused by a surface temperature range of 180 degrees F. without causing buckling, stresses on glass, failure of joint seals, undue stress on structural elements, damaging loads on fasteners, reduction of performance, or other detrimental effects. Operating windows and doors shall function normally over this temperature range.

   2. Structural performance:
      a. Complete storefront and entrance framing system shall be designed to withstand wind loading complying with local codes; the International Building Code, 2006 Edition with Georgia Amendments, loads acting normal to wall plane. Test per ASTM E330-02, Procedure A.
b. Deflection of framing members in a direction normal to wall plane, when subjected to a uniform load deflection test at design pressures specified above, in accord with ASTM E330-02, Procedure A, shall not exceed 1/175 of its clear span except that when a plastered surface subjected bending is affected, deflection shall not exceed 1/360 of the span.

c. No glass breakage. Conduct uniform load structural test in accord with ASTM E330-02, Procedure A.
   1) Inward and outward test pressures shall be equal to 1.5 times inward and outward acting design wind pressures specified herein.
   2) At conclusion of tests, there shall be no glass breakage, permanent damage to fasteners or anchors, hardware parts or actuating mechanism.
   3) Windows, doors and operating hardware shall function satisfactorily. Storefront and entrance framing members shall have no permanent deformation.

d. Deflection of members in a direction parallel to wall plane, when carrying their full load, shall not exceed an amount which will reduce the glass bite below 75% of the design dimension and the member shall have a 1/8” minimum clearance between itself and the top of the fixed panel, glass, or other fixed part immediately below. Clearance between the member and an operable window or door shall be at least 1/16”.

3. Static pressure air infiltration of exterior storefront:
   a. Air leakage rate through fixed light areas of storefront system shall not exceed 0.06 cfm per square foot when tested in accord with ASTM E283-04 at a differential static pressure of 6.24 psf.
   b. Air leakage rate through entrance doors shall not exceed 1.0 cfm per square foot when tested in accord with ASTM E283-04 at a differential static pressure of 1.57 psf.

4. Static pressure water infiltration of exterior storefront:
   a. Water penetration is defined as the appearance of uncontrolled water other than condensation on the indoor face of wall construction.
   b. Make provision for water entering at joints and condensation occurring within wall construction to drain to exterior face.
   c. Fixed light areas of storefront shall permit no uncontrolled water penetration when tested in accord with ASTM E331-00(2009). Differential static pressure used in the test shall be 10% of the upward acting design wind load specified herein but not less than 8.0 psf.

5. Thermal performance of exterior storefront when tested in accord with AAMA 1503:
   Fixed light area of storefront shall have a maximum thermal transmittance not exceeding a U-value of 0.44 (low-e) or 0.61 (clear) BTUH/ft²/degree F. when tested in accord with AAMA 1503.1.


7. Sound Transmission Class (STC) and Outdoor-Indoor Transmission Class (OITC):
   When tested in accord with AAMA 1801 the STC and OITC rating shall not be less than: 35 (STC) and 29 (OITC).

1.4 SUBMITTALS

A. Shop drawings: Indicate in elevation with sections and details at full scale. Include glass and metal thicknesses, joining details, field connections, anchorage, provisions for expansion, fastening and sealing methods, splice details, reinforcement, metal finishes and glazing accessories. Indicate relationship to adjacent work. Indicate compliance with specified design criteria.
B. Product data: Provide manufacturer's complete product description, including test reports, certifying that system meets specified design criteria. Submit structural calculations for project conditions. Mark manufacturer's brochures to include only those products proposed for use.

C. Samples:
   1. 3 x 3 inch finish samples in specified color indicating full range of color to be expected in finished work.
   2. 12 inch long aluminum framing system samples showing profile and finish.
   3. 12 x 12 inch door corner showing corner construction, reinforcement, and glazing.
   4. Each hardware item.
   5. Sealant adhesion test samples: Provide samples of specified metal finish for adhesion tests by sealant manufacturer, as specified in Joint Sealants section.

D. Test reports: Submit for Architect's information only.
   1. Submit reports by an independent Testing Laboratory that storefront system proposed for use has been tested for compliance with specified design criteria.
   2. Certified results of previous tests by a recognized independent laboratory substantiating compliance with specified design and performance criteria must be current within past 5 years.
   3. Tests shall have been made for essentially similar systems having similar glass sizes, mullion lengths, reinforcement and methods of attachment.
   4. Tests shall indicate satisfactory testing to at least structural performance criteria specified.
   5. If test data is not available for proposed systems or if data does not represent project conditions, Contractor shall be responsible for securing satisfactory tests by an independent Testing Agency acceptable to Architect. Costs for such testing shall be borne by Contractor.

E. Glass manufacturer's approval: Indicate on shop drawings, or by letter prior to submission of shop drawings, that selected glass manufacturers have reviewed and approved details, including glass bite, clearances, system weepage, air circulation around interior window treatments, shading by exterior building components and glazing methods.

F. Maintenance data: Submit as part of Contract closeout documents. Give instructions for general maintenance and repair of surfaces and finishes. Include detailed re-glazing procedures.

1.5 QUALITY ASSURANCE

A. Installer Qualifications: An installer which has had successful experience with installation of the same or similar units required for the project and other projects of similar size and scope.

B. Manufacturer Qualifications: A manufacturer capable of providing aluminum framed storefront system that meet or exceed performance requirements indicated and of documenting this performance by inclusion of test reports, and calculations.

C. Source Limitations: Obtain aluminum framed storefront and curtainwall systems through one source from a single manufacturer.

D. Product Options: Drawings indicate size, profiles, and dimensional requirements of aluminum framed storefront system and are based on the specific system indicated. Refer to Division 01 Section "Product Requirements." Do not modify size and dimensional requirements.
   1. Do not modify intended aesthetic effects, as judged solely by Architect, except with Architect's approval. If modifications are proposed, submit comprehensive explanatory data to Architect for review.
E. Mockups: Build mockups to verify selections made under sample submittals and to demonstrate aesthetic effects and set quality standards for materials and execution.
   1. Build mockup for type(s) of storefront elevation(s) indicated, in location(s) shown on Drawings.

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


H. Structural-Sealant Joints: Design reviewed and approved by structural-sealant manufacturer.

1.6 PROJECT CONDITIONS

A. Field Measurements: Verify actual dimensions of aluminum framed storefront openings by field measurements before fabrication and indicate field measurements on Shop Drawings.

B. Protection: Protect aluminum surfaces from contact with lime, mortar, cement, acids and other harmful surfaces and from careless handling, storage or machining.

1.7 WARRANTIES

A. Manufacturer’s warranty: Warrant the work of this section for five years to be free from defects in workmanship and materials and that the work conforms to the final shop drawings. Warranty shall apply to both patent and latent defects but shall not include damage caused by exclusions stated in manufacturer’s warranty.

B. Warranties commence at Date of Material Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Acceptable Manufacturers:
   2. YKK AP America, Inc.
   3. Vistawall Group, Oldcastle Glass Engineered Products.

2.2 MATERIALS AND FINISH

A. Structural characteristics of aluminum shall be in accord with AA "Specification for Aluminum Structures."

B. Aluminum extruded bars, rods, shapes, and tubes: Meeting ASTM B221-08; alloy, temper and wall thickness as required to meet design criteria.

C. Aluminum sheet and plate: 5005-H34 aluminum alloy meeting ASTM B209-07 minimum 0.050” thickness

D. Bars, rods and wire: Meeting ASTM B211-03.

E. Standard structural shapes: Meeting ASTM B308-02.

F. Carbon steel:
   1. Structural shapes, plates and bars: Meeting ASTM A36-08.
2. Sheet and strip, cold rolled, structural quality: ASTM A1008-08a, Grades A through E.
3. Sheet and strip, hot rolled Structural quality: ASTM A1011-09, Grades A through E.
4. Sheet, hot dip galvanized, structural quality: Meeting ASTM A653-08, Grades A through F.
5. Sheet, electrolytic zinc coated: Meeting ASTM A879-06.

G. Fasteners: Exposed fasteners shall be countersunk and shall match entrances and storefronts in color.
1. Aluminum to aluminum: Aluminum or Type 304 stainless steel.
2. Aluminum to stainless steel or carbon steel: Type 304 Stainless steel.

H. Protective coatings for metals:
1. Painting for carbon steel and high strength steel:
   a. Dry environment: SSPC-PS 1.09, Three-Coat Oil Base Zinc Oxide Painting System.
   b. Frequently wet environment: SSPC-PS 13.01, Epoxy-Polyamide Painting System.
   c. Frequently wet salt water environment: SSPC-PS 12.01, One-Coat Zinc Rich Painting System.
2. Galvanizing of carbon steel:
   a. Steel sheets: Meeting ASTM A653-08.
   b. Hot dip for shapes, plates, bars and strips: Meeting ASTM A123-08.
   d. Weight of coating: Meeting ASTM A123-08, Grade 65.
3. Cold galvanizing compound: Pre-mixed, zinc dust and organic binders formulated specifically for use on steel surfaces. Compounds shall have concentrations of zinc dust in the range of 65% to 69% or above 92% in the dried film in accord with ASTM A780-01(2006).

I. 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 0.7 mils.
      1) CASS Corrosion Resistance Test, CASS 240/ASTM 8368 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.
2. Color: Dark Bronze.

2.3 ENTRANCE DOORS

A. Medium stile design: Minimum 3 1/2" wide stiles and top rail and 6 1/2" wide bottom rail.

B. Door construction: Fabricated of extruded aluminum sections with door corners joined by
concealed reinforcement, secured with bolts and screws and by Sigma deep penetration welding.

C. Glazing:
   1. Snap-in stops with neoprene glazing gaskets.
   2. Glass and glazing accessories shall be as specified in Section 08 8000 Glazing.
   3. Single glazing on doors only.

D. Drip cap: Provide doors with drip cap at head and bottom rail to prevent water infiltration.

E. Adjustment: Doors equipped with adjusting mechanism located in top rail near lock stile, providing for minor clearance adjustments after installation.

F. Weatherstripping:
   1. Pile type in replaceable rabbets for stiles and rails; complying with AAMA 701.2/702.
   2. Provide weatherstripping at all interior and exterior aluminum-framed entrances.

G. Hardware: Provide as specified in Door Hardware section.

2.4 EXTERIOR STOREFRONTS AND ENTRANCE FRAMING SYSTEM

A. Basis of design: TriFab VG 451T and TriFab 601T. Locations as indicated on the drawings.

B. Framing characteristics:
   1. Member size: 2" by 4-1/2" and 2" by 6".
   2. System: Two-piece face and gutter.
   3. Construction: Shear block or screw spline.
   4. Glazing gaskets: As specified in Glazing section.
   5. Make provisions in framing for minimum edge clearance, nominal edge cover, and nominal pocket width for thickness and type of glazing material indicated on drawings. Provisions shall be in accord with glazing material manufacturer's product data.
   6. Framing shall accommodate entrance doors indicated in door schedule and other components indicated on drawings.
   7. Provide framing with reinforcing members meeting design wind loading and design criteria in accord with shop drawings. Subframes and reinforcing members of carbon steel shall have a shop applied protective coating as specified herein.
   8. Thermal barrier: Poured and debridged continuous structural thermal barrier.

C. Sealants:
   1. Storefront sealant: Non-skinning sealant meeting AAMA Publication 800-05 with addenda; color matching storefront color.
   2. Perimeter sealant: As specified in Joint Sealants section.
   3. Sealants used shall have a VOC content of 250 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

D. Weep hole filter material: 1/2" square by 6" long; 30-40 ppi, open cell, reticulated, polyvinyl chloride-coated, polyurethane foam block.

E. Framing anchors: Series 300 stainless steel for exposed fasteners and fasteners 1/4" diameter and smaller; heavy zinc-plated steel, (0.0005" thickness plating), colored chromate-coated for fasteners over 1/4" diameter. Framing anchors shall carry dead load, accommodate thermal movement, resist wind load specified herein and withstand normal loads imposed by entrance door operation.

F. Bituminous coating for separation of dissimilar materials: Cold-applied, asphalt mastic meeting SSPC-PS 9.01, minimum 30 mils thickness.
G. Fabricate trim pieces from sheet or plate aluminum meeting requirements specified herein.

H. Flashings and other materials used internally or externally shall be corrosion resistant, non-staining, non-bleeding and compatible with adjoining materials.

2.5 INTERIOR STOREFRONTS AND ENTRANCE FRAMING SYSTEM

A. Basis of design: TriFab 601.

B. Framing characteristics:
   1. Member size: 2" by 6".
   2. System: Two-piece face and gutter.
   3. Construction: Shear block or screw spline.
   4. Glazing gaskets: As specified in Glazing section.
   5. Make provisions in framing for minimum edge clearance, nominal edge cover, and nominal pocket width for thickness and type of glazing material indicated on drawings. Provisions shall be in accord with glazing material manufacturer's product data.
   6. Framing shall accommodate entrance doors indicated in door schedule and other components indicated on drawings.
   7. Provide framing with reinforcing members meeting design wind loading and design criteria in accord with shop drawings. Subframes and reinforcing members of carbon steel shall have a shop applied protective coating as specified herein.

C. Sealants:
   1. Storefront sealant: Non-skimming sealant meeting AAMA Publication 800-05 with addenda; color matching storefront color.
   2. Perimeter sealant: As specified in Joint Sealants section.
   3. Sealants used shall have a VOC content of 250 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

D. Weep hole filter material: 1/2" square by 6" long; 30-40 ppi, open cell, reticulated, polyvinyl chloride-coated, polyurethane foam block.

E. Framing anchors: Series 300 stainless steel for exposed fasteners and fasteners 1/4" diameter and smaller; heavy zinc-plated steel, (0.0005" thickness plating), colored chromate-coated for fasteners over 1/4" diameter. Framing anchors shall carry dead load, accommodate thermal movement, resist wind load specified herein and withstand normal loads imposed by entrance door operation.

F. Bituminous coating for separation of dissimilar materials: Cold-applied, asphalt mastic meeting SSPC-PS 9.01, minimum 30 mils thickness.

G. Fabricate trim pieces from sheet or plate aluminum meeting requirements specified herein.

H. Flashings and other materials used internally or externally shall be corrosion resistant, non-staining, non-bleeding and compatible with adjoining materials.

2.6 FABRICATION:

A. General: Storefront and entrance systems shall be of materials, design, sizes and thicknesses, subject to commercial tolerances, indicated on approved shop drawings and specified herein. Methods of fabrication and assembly, unless specifically stated otherwise, shall be at manufacturer's discretion.

B. Joints: Fabricate and assemble framing with joints only at intersections of members. Match exposed work to produce continuity of line and design, with joints, unless indicated otherwise, being accurately fitted and rigidly secured.
C. Hardware: Drill and cut to template for finish hardware. Reinforce frames and door stiles and rails to receive finish hardware in accord with door manufacturer's product data. Coordinate, prep, and provide concealed pathways for access control wiring as required for access control system where indicated.

D. Protection of metals: Protect against galvanic action wherever dissimilar metals are in contact. Provide protection by painting contact surfaced with zinc chromate primer as specified herein or by application of a sealant or tape.

E. Welding:
   1. Welding shall be in accord with AWS criteria and shall be done with electrodes and by methods recommended by suppliers of metals being welded. Type, size and spacing of welds shall be as indicated on approved shop drawings.
   2. Perform welding behind finished surfaces so as to minimize distortion and discoloration on finished side. Remove weld spatter and welding oxides on finished surfaces by descaling and grinding.

F. Shop painting of steel: Items of steel, unless galvanized or scheduled for other finish, shall be cleaned of loose scale, dirt and foreign matter in accord with SSPC-SP 6/NACE No. 3, Commercial Blast Cleaning, and shall be coated/primed as specified herein.

G. Sealants and sealing materials: Use sealants and sealing materials in accord with material manufacturer's product data and joints shall be in accord with designs and tolerances indicated on approved shop drawings.

H. Shop glazing: Perform glazing work in accord with recommendations of GANA Glazing Manual and glazing material manufacturer's product data.

2.7 ACCESSORIES

A. Fasteners:
   1. Series 300 stainless steel for wet locations and exposed fasteners.
   2. Stainless or fluoropolymer coated steel for other locations.

B. Joint Sealers: Specified in Section 07 9200.

C. Glass and Glazing Accessories: Specified in Section 08 8000.

D. Weatherstripping: Replaceable, nonporous synthetic wool pile type.

PART 3 - EXECUTION

3.1 PREPARATION:

A. Storefronts: Establish bench marks at convenient points adjacent to each entrance. Be responsible for accuracy of location of perimeter lines and elevation of bench marks.

B. Correction of errors: Should errors be found in location or elevation of perimeter lines and elevation of bench marks, installation of work shall not proceed in affected areas until errors have been corrected.

3.2 INSTALLATION:

A. Install aluminum entrances and storefronts in accord with manufacturer's product data and approved shop drawings, plumb, level and true to line, in proper alignment and relation to established lines and grades, within specified tolerances.
B. Install panels plumb and true in proper alignment and relation to framing and established lines and grades, as indicated on approved shop drawings.

C. Anchor entrance doors in place, straight, plumb and level, without distortion, in accord with approved shop drawings. Check and adjust weatherstripping contact and hardware movement for proper operation and performance of units.

D. Erection tolerances: Components of storefront system shall be within the following tolerances:
   1. Maximum variation from plane or location indicated on approved shop drawings: 1/8" per 12'-0" of length or 1/2" in any total length.
   2. Maximum offset from true alignment between two members abutting end to end in line: 1/16".
   3. Maximum offset between framing members at corners of glazing pocket: 1/32".

E. Installation within masonry openings: No parts other than built-in anchor devices shall be installed until masonry work is completed and cleaned.

F. Protect aluminum in contact with masonry, steel, concrete or other dissimilar material from contact by neoprene gaskets or bituminous coating.

G. Before anchoring to structure, shim and brace work plumb, level and in designated location. Anchorage of storefront framing to building structure shall be in accord with approved shop drawings. After wall is positioned, connections indicated on approved shop drawings shall be rigidly fixed.

H. Welding: Protect glass and finished surfaces from damage from weld spatter. Welds and adjacent metal shall be cleaned and primed with primer specified herein.

I. Provide sill flashing at exterior storefronts. Flashing shall extend continuous, with joints lapped and set in storefront sealant. Provide end dams minimum 2" high.

J. Install weep hole baffle with filter at weep holes. Install filter under 30% compression.

K. During installation, verify that storefront system allows water which enters the system to be collected in gutters and weeped to exterior. Ascertain that weep holes are open and that metal-to-metal joints are sealed.

L. Locate expansion mullions in accord with manufacturer’s recommendations as indicated on approved shop drawings.

M. Caulking:
   1. Caulk metal-to-metal internal storefront joints using storefront sealant. Install in accord with Joint Sealants section.
   2. Caulk perimeter of storefronts using silicone sealant as specified in Joint Sealants section. Caulk both exterior and interior faces of storefront perimeter.
   3. Caulk fasteners heads penetrating storefront jamb, sill and head members.

N. Clean exposed aluminum surfaces at completion of work, just prior to Date of Substantial Completion. Repair or replace work damaged or stained by subsequent work.

O. Field tests: Conduct to ascertain that storefront system is watertight. Conduct generally in accord with AAMA 501.2. A minimum of two tests shall be performed. Tests shall be performed in the presence of Architect.

3.3 ADJUSTING, CLEANING, AND PROTECTION
A. Cleaning:
   2. Clean glass immediately after installation. Comply with glass manufacturer’s written recommendations for final cleaning and maintenance. Remove nonpermanent labels, and clean surfaces.
   3. Remove and replace glass that has been broken, chipped, cracked, abraded, or damaged during construction period.

B. Adjusting:
   1. Adjust hardware for smooth operation.
   2. Adjust doors to operate with maximum opening forces in accordance with applicable accessibility code.
   3. Adjust weatherstripping to contact appropriate surfaces and form weather seal.

C. Touch up minor scratches and abrasions to match original finish.

APPENDIX – SCHEDULE OF SUBMITTALS

<table>
<thead>
<tr>
<th>Submittal Number</th>
<th>Item Number</th>
<th>Description</th>
<th>Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td>08 4113</td>
<td></td>
<td><strong>Aluminum-Framed Entrances &amp; Storefronts</strong></td>
<td></td>
</tr>
<tr>
<td></td>
<td>084113-1.4-A-01</td>
<td>Shop Drawings</td>
<td>Include 08 4229 Automatic Entrances</td>
</tr>
<tr>
<td></td>
<td>084113-1.4-B-01</td>
<td>Product Data – Aluminum-Framed Entrances &amp; Storefronts</td>
<td></td>
</tr>
<tr>
<td></td>
<td>084113-1.4-C-01</td>
<td>Samples - Finish</td>
<td></td>
</tr>
<tr>
<td></td>
<td>084113-1.4-C-02</td>
<td>Samples - Profile</td>
<td>Requested by Architect only if not providing basis of design items</td>
</tr>
<tr>
<td></td>
<td>084113-1.4-C-03</td>
<td>Samples - Hardware</td>
<td></td>
</tr>
<tr>
<td></td>
<td>084113-1.4-C-04</td>
<td>Adhesion Test Report</td>
<td></td>
</tr>
<tr>
<td></td>
<td>084113-1.4-D-01</td>
<td>Product Test Reports</td>
<td></td>
</tr>
<tr>
<td></td>
<td>084113-1.4-E-01</td>
<td>Glass Manufacturer’s Approval</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td><strong>Project Close-Out Submittal</strong></td>
<td>Provide at date of material completion</td>
</tr>
<tr>
<td></td>
<td>084113-1.4-F-01</td>
<td>Maintenance Data</td>
<td></td>
</tr>
<tr>
<td></td>
<td>084113-1.7-A-01</td>
<td>Manufacturer’s Warranty</td>
<td></td>
</tr>
</tbody>
</table>
PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Aluminum framed sliding automatic entrance doors and frames.
   2. Activators and controls.

B. Related Sections:
   1. Division 01 - Administrative, procedural, and temporary work requirements.
   2. Section 07 9200 - Joint Sealers
   3. Section 08 4113 – Aluminum Framed Entrances & Storefront
   4. Section 08 7100 - Door Hardware.
   5. Section 08 8000 - Glazing.
   6. Division 26 Sections for electrical connections provided separately, including conduit and wiring, for power to sliding automatic entrances.

1.2 REFERENCES

A. American Architectural Manufacturers Association (AAMA):
   1. CW-10 - Care and Handling of Architectural Aluminum from Shop to Site.
   2. 611 - Voluntary Specification for Anodized Architectural Aluminum.

B. American Association of Automatic Door Manufacturers (AAADM)

C. American National Standards Institute/Builders Hardware Manufacturers Association (ANSI/BHMA):
   1. A156.5: Standard for Auxiliary Locks and Associated Products

D. ASTM International (ASTM):

E. National Association of Architectural Metal Manufacturers (NAAMM):
   1. Metal Finishes Manual for Architectural and Metal Products.

1.3 SUBMITTALS

A. Shop Drawings:
   1. Indicate system dimensions, framed opening requirements and tolerances, trim, sealers, hardware, and accessories.
   2. Identify installation tolerances, routing of power and control lines, and locations of operating equipment.
B. Product Data: Include product descriptions and installation instructions for each material. Mark manufacturer's brochures to include only those products proposed for use.

C. Samples:
1. 3 x 3 inch coating samples in specified color.
2. 12 inch long aluminum framing system samples showing profile and finish.
3. 6 x 6 inch door corner showing corner construction, reinforcing, and glazing.

D. Closeout Submittals:
2. Operation and Maintenance Data.

1.4 QUALITY ASSURANCE

A. Installer Qualifications: Manufacturer's authorized representative, with certificate issued by AAADM, who is trained for installation and maintenance of units required for this Project.

B. Source Limitations: Obtain automatic entrance door assemblies through one source from a single manufacturer.

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. Emergency-Exit Door Requirements: Comply with requirements of authorities having jurisdiction for automatic entrances serving as a required means of egress.

1.5 DELIVERY, STORAGE AND HANDLING

A. Handle products in accordance with AAMA CW-10.

1.6 PROJECT CONDITIONS

A. Field Measurements: General Contractor shall verify openings to receive automatic entrance door assemblies by field measurements before fabrication and indicate measurements on Shop Drawings.

B. Mounting Surfaces: General Contractor shall verify all surfaces to be plumb, straight and secure; substrates to be of proper dimension and material.

C. Other trades: General Contractor shall advise of any inadequate conditions or equipment.

1.7 COORDINATION

A. Templates: Check Shop Drawings of other work to confirm that adequate provisions are made for locating and installing automatic entrances to comply with indicated requirements.

B. Electrical System Roughing-in: Coordinate layout and installation of automatic entrance door assemblies with connections to power supplies.

1.8 WARRANTY

A. Automatic Entrances shall be free of defects in material and workmanship for a period of one (1) year from the Date of Substantial Completion.

PART 2 - PRODUCTS
2.1 MANUFACTURERS

A. Acceptable Manufacturers:
   3. Horton Automatics. (www.hortondoors.com)

2.2 AUTOMATIC ENTRANCES

A. Basis of design: Stanley Access Technologies; Dura-Glide 3000 Series sliding automatic entrances.

2.3 MATERIALS

A. Aluminum: Alloy and temper recommended by manufacturer for type of use and finish indicated.
   2. Extruded Bars, Rods, Profiles, and Tubes: ASTM B 221.

B. Sealants and Joint Fillers: Performed under Division 7 Section "Joint Sealants".

C. Glass and Glazing Accessories: Specified in Section 08 8000.

2.4 AUTOMATIC ENTRANCE DOOR ASSEMBLIES

A. General: Provide manufacturer's standard automatic entrance door assemblies including doors, sidelights, framing, headers, carrier assemblies, roller tracks, door operators, activation and safety devices, and accessories required for a complete installation.

B. Sliding Automatic Entrances:
   1. Bi-Parting Entrances:
      a. Configuration: Two sliding leaves and two full sidelights.
      c. Emergency Breakaway Capability: Sliding leaves only.
      d. Mounting: Between jambs.

2.5 COMPONENTS

A. Framing Members: Manufacturer's standard extruded aluminum reinforced as required to support imposed loads.
   1. Nominal Size: 1 3/4 inch by 6 inch (45 by 152 mm).
   2. Concealed Fastening: Framing shall incorporate a concealed fastening pocket, and continuous flush insert cover, extending full length of each framing member.

B. Stile and Rail Doors and Sidelights: Manufacturer's standard 1 ¾ inch (45 mm) thick glazed doors with extruded-aluminum tubular stile and rail members. Incorporate concealed tie-rods that span full length of top and bottom rails.
   2. Stile Design: Narrow stile; 2 inch (51 mm) nominal width.
   3. Bottom Rail Design: Minimum 10 inch (254 mm)] [12 inch (305 mm) nominal height.
   4. Muntin Bars: 4 1/4 inch (108 mm)] nominal width.

C. Glazing: Furnished under Division 8 Section Glazing. All Glazing furnished under separate section shall be 1 inch (25 mm) insulated, hermatically sealed.
D. Headers: Fabricated from extruded aluminum and extending full width of automatic entrance door units to conceal door operators, carrier assemblies, and roller tracks. Provide hinged or removable access panels for service and adjustment of door operators and controls. Secure panels to prevent unauthorized access.
   1. Mounting: Concealed, with one side of header flush with framing.
   2. Capacity: Capable of supporting up to 220 lb (100 kg) per panel, up to four panels, over spans up to 14 feet (4.3 m) without intermediate supports.

E. Carrier Assemblies and Overhead Roller Tracks: Manufacturer's standard carrier assembly that allows vertical adjustment of at least 1/8 inch (3 mm); consisting of urethane with precision steel lubricated ball-bearing wheels, operating on a continuous roller track. Support panels from carrier assembly by load wheels and anti-riser wheels with factory adjusted cantilever and pivot assembly. Minimum two ball-bearing load wheels and two anti-rise rollers for each active leaf. Minimum load wheel diameter shall be 2 1/2 inch (64 mm); minimum anti-rise roller diameter shall be 2 inch (51 mm).

F. Thresholds: Manufacturer's standard thresholds as indicated below:
   1. Continuous standard tapered extrusion double bevel.
   2. All thresholds to conform to details and requirements for code compliance.

G. Fasteners and Accessories: Manufacturer's standard corrosion-resistant, non-staining, non-bleeding fasteners and accessories compatible with adjacent materials.

H. Signage: Provide signage in accordance with ANSI/BHMA A156.10.

2.6 DOOR OPERATORS

A. General: Provide door operators of size recommended by manufacturer for door size, weight, and movement; for condition of exposure; and for long-term, operation under normal traffic load for type of occupancy indicated.

B. Electromechanical Operators: Self-contained overhead unit powered by a minimum of 1/4 horsepower, permanent-magnet DC motor with gear reduction drive, microprocessor controller; and encoder.
   2. Features:
      a. Adjustable opening and closing speeds.
      b. Adjustable back-check and latching.
      c. Adjustable braking.
      d. Adjustable hold-open time between 0 and 30 seconds.
      e. Obstruction recycle.
      f. On/Off switch to control electric power to operator.
      g. Energy conservation switch that reduces door-opening width.
      h. Closed loop speed control with active braking and acceleration.
      i. Adjustable obstruction recycle time delay.
      j. Self-adjusting stop position.
      k. Self-adjusting closing compression force.
      l. Onboard sensor power supply.
      m. Onboard sensor monitoring.
      n. Optional Switch to open/Switch to close operation.
   4. Drive System: Synchronous belt type.

C. Electrical service to door operators shall be provided under Division 26 Electrical. Minimum service to be 120 VAC, 5 amps.

2.7 ELECTRICAL CONTROLS
A. Electrical Control System: Electrical control system shall include a microprocessor controller and position encoder. The encoder shall monitor revolutions of the operator shaft and send signals to microprocessor controller to define door position and speed. Systems utilizing external magnets and magnetic switches are not acceptable.

B. Performance Data: The microprocessor shall collect and store performance data as follows:
   1. Counter: A non-resettable counter to track operating cycles.
   2. Event Reporting: Unit shall include event and error recording including number of occurrences of events and errors, and cycle count of most recent events and errors.
   3. LED Display: Display presenting the current operating state of the controller.

C. Controller Protection: The microprocessor controller shall incorporate the following features to ensure trouble free operation:
   2. Main Fuse Protection.
   3. Electronic Surge Protection.
   5. Resetable sensor supply fuse protection.

D. Soft Start/Stop: A “soft-start” “soft-stop” motor driving circuit shall be provided for smooth normal opening and recycling.

E. Obstruction Recycle: Provide system to recycle the sliding panels when an obstruction is encountered during the closing cycle. If an obstruction is detected, the system shall search for that object on the next closing cycle by reducing door closing speed prior to the previously encountered obstruction location, and will continue to close in check speed until doors are fully closed, at which time the doors will reset to normal speed. If obstruction is encountered again, the door will come to a full stop. The doors shall remain stopped until obstruction is removed and operate signal is given, resetting the door to normal operation.

F. Programmable Controller: Microprocessor controller shall be programmable and shall be designed for connection to a local configuration tool. Local configuration tool shall be a software driven handheld interface. The following parameters may be adjusted via the configuration tool:
   1. Operating speeds and forces as required to meet ANSI/BHMA A156.10.
   2. Adjustable and variable features as specified in 2.5, B., 2.
   3. Reduced opening position.
   4. Fail Safe/Secure control.
   5. Firmware update.
   6. Trouble Shooting
      a. I/O Status.
      b. Electrical component monitoring including parameter summary.
   7. Software for local configuration tool shall be available as a free download from the sliding automatic entrance manufacturer’s internet site. Software shall be compatible with the following operating system platforms: Palm®, Android®, and Windows Mobile®.

2.8 ACTIVATION AND SAFETY DEVICES

A. Motion Sensors: Motion sensors shall be mounted on each side of door header to detect pedestrians in the activating zone, and to provide a signal to open doors in accordance with ANSI/BHMA A156.10. Units shall be programmable for bi-directional or uni-directional operation and shall incorporate K-band microwave frequency to detect all motion in both directions.
B. Presence Sensors: Presence sensors shall be provided to sense people or objects in the threshold safety zone in accordance with ANSI/BHMA A156.10. Units shall be self-contained, fully adjustable, and shall function accordingly with motion sensors provided. The sensor shall be enabled simultaneously with the door-opening signal and shall emit an elliptical shaped infrared presence zone, centered on the doorway threshold line. Presence sensors shall be capable of selectively retuning to adjust for objects which may enter the safety zone; tuning out, or disregarding, the presence of small nuisance objects and not tuning out large objects regardless of the time the object is present in the safety zone. The door shall close only after all sensors detect a clear surveillance field.

C. Photoelectric Beams: In addition to the threshold sensor include a minimum of two (2) doorway holding beams. Photoelectric beams shall be pulsed infrared type, including sender receiver assemblies for recessed mounting.

D. Presence Sensor Monitoring: Sliding automatic entrances control system shall include a means to verify the functionality of all active presence sensors in accordance with ANSI/BHMA A156.10. A detected fault shall cause automatic operation to cease until the fault is corrected.

2.9 HARDWARE

A. General: Provide units in sizes and types recommended by automatic entrance door and hardware manufacturers for entrances and uses indicated.

B. Emergency Breakaway Feature: Provide release hardware that allows panel(s) to swing out in direction of egress to full 90 degrees from any position in sliding mode. Maximum force to open panel shall be 50 lbf (222 N) according to ANSI/BHMA A156.10. Interrupt powered operation of panel operator while in breakaway mode.

1. Emergency breakaway feature shall include at least one adjustable detent device mounted in the top of each breakaway panel to control panel breakaway force.

2. Limit Arms: Limit arms shall be provided to control swing of sliding or non-sliding panels on break-out; swing shall not exceed 90 degrees. Limit arms shall be spring loaded to prevent shock, and include adjustable friction damping.

C. Deadlocks: Manufacturer's standard deadbolt operated by exterior cylinder and interior thumb turn; with minimum 1 inch (25 mm) long throw bolt; ANSI/BHMA A156.5, Grade 1.

1. Cylinders: As specified in Division 8 Section "Door Hardware."

2. Hook Latch: Laminated-steel hook, mortise type, BHMA A156.5, Grade 1.

3. Two-Point Locking: On bi-parting entrances, provide locking system that incorporates a device in the stile of active door leaves that automatically extends a flush bolt into overhead carrier assembly.

D. Control Switch: Provide manufacturer's standard header mounted rocker switches and door position switch to allow for full control of the automatic entrance door. Controls to include, but are not limited to:

1. One-way traffic

2. Reduced Opening

3. Open/Closed/Automatic

E. Power Switch: Sliding automatic entrances shall be equipped with a two position On/Off rocker switch to control power to the door.

F. Sliding Weather Stripping: Manufacturer's standard replaceable components complying with AAMA 701; made of wool, polypropylene, or nylon woven pile with nylon-fabric or aluminum-strip backing.

G. Weather Sweeps: Manufacturer's standard adjustable nylon brush sweep mounted to
underside of door bottom.

2.10 FABRICATION

A. General: Factory fabricates automatic entrance door assembly components to designs, sizes, and thickness indicated and to comply with indicated standards.
   1. Form aluminum shapes before finishing.
   2. Use concealed fasteners to greatest extent possible.
      a. Where fasteners are subject to loosening or turning out from thermal and structural movements, wind loads, or vibration, use self-locking devices.
      b. Reinforce members as required to receive fastener threads.
   3. Fabricate with minimum clearances and shim spaces around perimeter, yet enabling installation and dynamic movement.
   4. Accurately fit and secure joints and intersections. Make joints flush, hairline, and weathertight.
   5. Fabricate in largest practical units.
   6. Conceal fasteners and attachments from view.
   7. Reinforce framing members with internal steel when required to support imposed loads.
   8. Form glass stops, exterior sills, closures, weatherstops, and flashings of same material as frame.

B. Framing: Provide automatic entrances as prefabricated assemblies.
   1. Fabricate tubular and channel frame assemblies with manufacturer's standard mechanical or welded joints. Provide sub-frames and reinforcement as required for a complete system to support required loads.
   2. Perform fabrication operations in manner that prevents damage to exposed finish surfaces.
   3. Form profiles that are sharp, straight, and free of defects or deformations.
   4. Prepare components to receive concealed fasteners and anchor and connection devices.
   5. Fabricate components with accurately fitted joints with ends coped or mitered to produce hairline joints free of burrs and distortion.

C. Doors: Factory fabricated and assembled in profiles indicated. Reinforce as required to support imposed loads and for installing hardware.

D. Door Operators: Factory fabricated and installed in headers, including adjusting and testing.

E. Glazing: Fabricate framing with minimum glazing edge clearances for thickness and type of glazing indicated.

F. Hardware: Factory install hardware to the greatest extent possible; remove only as required for final finishing operation and for delivery to and installation at Project site.

2.11 ALUMINUM FINISHES

A. General: Comply with NAAMM Metal Finishes Manual for Architectural and Metal Products for recommendations for applying and designing finishes. Finish designations prefixed by AA comply with system established by Aluminum Association for designing finishes.

B. [Class I, Color Anodic Finish: AA-M12C22A42/A44 Mechanical Finish: as fabricated; Chemical Finish: etched, medium matte; Anodic Coating: Architectural Class I, integrally colored or electrolytically deposited color coating 0.70 mils minimum complying with AAMA 611-98, and the following:
   1. Color: Dark Bronze.
   2. AAMA 606.1]
3. Applicator must be fully compliant with all applicable environmental regulations and permits, including wastewater and heavy metal discharge.]

**PART 3 - EXECUTION**

### 3.1 INSPECTION

A. Examine conditions for compliance with requirements for installation tolerances, header support, and other conditions affecting performance of automatic entrances. Proceed with installation only after unsatisfactory conditions have been corrected.

### 3.2 INSTALLATION

A. General:
   1. Do not install damaged components.
   2. Fit frame joints to produce joints free of burrs and distortion.
   3. Rigidly secure non-movement joints.
   4. Install in accordance with manufacturer's instructions and approved Shop Drawings.
   5. Install components plumb and level, in proper plane, free from warp and twist.
   6. Anchor to supporting construction.
   7. Set thresholds and sill members exposed to weather in mastic and secure.
   8. Install hardware using templates provided.
   9. Install glass and accessories in accordance with Section 08 8000.

B. Entrances: Install automatic entrances plumb and true in alignment with established lines and grades without warp or rack of framing members and doors. Anchor securely in place.
   1. Install surface-mounted hardware using concealed fasteners to greatest extent possible.
   2. Set headers, carrier assemblies, tracks, operating brackets, and guides level and true to location with anchorage for permanent support.

C. Door Operators: Connect door operators to electrical power distribution system as specified in Division 26 Sections.

D. Glazing: Performed under Division 8 Section "Glazing" in accordance with sliding automatic entrance manufacturer's instructions.

E. Sealants: Comply with requirements specified in Division 7 Section "Joint Sealants".

F. Installation Tolerances:
   1. Maximum variation from plumb or level: 1/8 inch in 3 feet or 1/4 inch in 10 feet, whichever is less. Maximum variation is non-cumulative.

### 3.3 FIELD QUALITY CONTROL

A. Testing Services: Factory Trained Installer shall test and inspect each automatic entrance door to determine compliance of installed systems with applicable ANSI standards.

### 3.4 ADJUSTING

A. Adjust door operators, controls, and hardware for smooth and safe operation, for tight closure, and complying with requirements in ANSI/BHMA A156.10.

B. Touch up minor scratches and abrasions to match original finish.

C. Adjust weatherstripping to contact appropriate surfaces and form weather seal.
3.5 CLEANING AND PROTECTION

A. Clean glass and aluminum surfaces promptly after installation. Remove excess glazing and sealant compounds, dirt, and other substances. Repair damaged finish to match original finish. Comply with requirements in Division 8 Section “Glazing”, for cleaning and maintaining glass.

APPENDIX – SCHEDULE OF SUBMITTALS

<table>
<thead>
<tr>
<th>Submittal Number</th>
<th>Item Number</th>
<th>Description</th>
<th>Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td>08 4229</td>
<td></td>
<td>Submittal</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Shop Drawings</td>
<td>Include with 08 4113 Aluminum Framed Entrances &amp; Storefronts</td>
</tr>
<tr>
<td>08 4229-1.3-B-01</td>
<td></td>
<td>Product Data – Automatic Entrances</td>
<td></td>
</tr>
<tr>
<td>08 4229-1.3-C-01</td>
<td></td>
<td>Sample - Finish</td>
<td></td>
</tr>
<tr>
<td>08 4229-1.3-C-02</td>
<td></td>
<td>Sample - Profile</td>
<td>Provide only if requested by Architect</td>
</tr>
<tr>
<td>08 4229-1.3-C-03</td>
<td></td>
<td>Samples – Corner Assembly</td>
<td>Provide only if requested by Architect</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Project Close-Out Documentation</td>
<td>Provide at date of material completion</td>
</tr>
<tr>
<td>04 7300-1.3-D-01</td>
<td></td>
<td>Maintenance Data</td>
<td></td>
</tr>
<tr>
<td>04 7300-1.8-A-01</td>
<td></td>
<td>Warranty</td>
<td></td>
</tr>
</tbody>
</table>

END OF SECTION
PART 1 - GENERAL

1.1 RELATED DOCUMENTS:

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

1.2 SUMMARY:

A. This Section includes items known commercially as finish or door hardware that are required for swing, sliding, and folding doors, except special types of unique hardware specified in the same sections as the doors and door frames on which they are installed.

B. This Section includes the following:
   1. Hinges
   2. Continuous hinges
   3. Key control system
   4. Lock cylinders and keys
   5. Lock and latch sets
   6. Bolts
   7. Exit devices
   8. Push/Pull units
   9. Closers
   10. Overhead holders
   11. Miscellaneous door control devices
   12. Door trim units
   13. Protection plates
   14. Weatherstripping for exterior doors
   15. Sound stripping for interior doors
   16. Thresholds

C. Related Sections: The following Sections contain requirements that relate to this Section:
   1. Section 08 1100: Hollow Metal Doors and Frames
   2. Section 08 1400: Wood Doors

D. Products furnished but not installed under this Section to include:
   1. Cylinders for locks on entrance doors.
   2. Final replacement cores and keys to be installed by Owner.

1.3 REFERENCES:

A. Standards of the following as referenced:
   1. American National Standards Institute (ANSI)
   2. Door and Hardware Institute (DHI)
   3. Factory Mutual (FM)
   4. National Fire Protection Association (NFPA)
   5. Underwriters' Laboratories, Inc. (UL)
a. UL 10C - Fire Tests Door Assemblies
6. Warnock Hersey

B. Regulatory standards of the following as referenced:

1.4 SYSTEM DESCRIPTION:
A. Refer to applicable “Headings” for system description for electric and electro-pneumatic hardware products.

1.5 SUBMITTALS:
A. Product data including manufacturers’ technical product data for each item of door hardware, installation instructions, maintenance of operating parts and finish, and other information necessary to show compliance with requirements. For items other than those scheduled in the “Headings” of Section 3, provide catalog information for the specified items and for those submitted.

B. Final hardware schedule coordinated with doors, frames, and related work to ensure proper size, thickness, hand, function, and finish of door hardware.
1. Final Hardware Schedule Content: Based on hardware indicated, organize schedule into vertical format “hardware sets” indicating complete designations of every item required for each door or opening. Use specification Heading numbers with any variations suffixed a, b, etc. Include the following information:
   a. Type, style, function, size, and finish of each hardware item.
   b. Name and manufacturer of each item.
   c. Fastenings and other pertinent information.
   d. Location of each hardware set cross-referenced to indications on Drawings both on floor plans and in door and frame schedule.
   e. Explanation of all abbreviations, symbols, and codes contained in schedule.
   f. Mounting locations for hardware.
   g. Door and frame sizes and materials.
   h. Keying information.
   i. Cross-reference numbers used within schedule deviating from those specified.
      1) Column 1: State specified item and manufacturer.
      2) Column 2: State prior approved substituted item and its manufacturer.

2. Submittal Sequence: Submit final schedule at earliest possible date particularly where acceptance of hardware schedule must precede fabrication of other work that is critical in the Project construction schedule. Include with schedule the product data, samples, shop drawings of other work affected by door hardware, and other information essential to the coordinated review of schedule.

3. Keying Schedule: Submit separate detailed schedule indicating clearly how the Owner’s final instructions on keying of locks has been fulfilled.
C. Samples of each type of exposed hardware unit in finish indicated and tagged with full description for coordination with schedule. Submit samples prior to submission of final hardware schedule.
   1. Samples will be returned to the supplier. Units that are acceptable and remain undamaged through submittal, review, and field comparison process may, after final check of operation, be incorporated in the Work, within limitations of keying coordination requirements.

D. Templates for doors, frames, and other work specified to be factory prepared for the installation of door hardware. Check shop drawings of other work to confirm that adequate provisions are made for locating and installing door hardware to comply with indicated requirements.

E. Contract closeout submittals:
   1. Operation and maintenance data: Complete information for installed door hardware.
   2. Warranty: Completed and executed warranty forms.

1.6 QUALITY ASSURANCE:

A. Single Source Responsibility: Obtain each type of hardware (latch and locksets, hinges, closers, etc.) from a single manufacturer.

B. Supplier Qualifications: A recognized architectural door hardware supplier, with warehousing facilities in the Project's vicinity, that has a record of successful in-service performance for supplying door hardware similar in quantity, type, and quality to that indicated for this Project and that employs an experienced architectural hardware consultant (AHC), or equivalent, who is available to Owner, Architect, and Contractor, at reasonable times during the course of the Work, for consultation.
   1. Require supplier to meet with Owner to finalize keying requirements and to obtain final instructions in writing.
   2. Required supplier to meet with installer prior to beginning of installation of door hardware.

C. Fire-Rated Openings: Provide door hardware for fire-rated openings that complies with NFPA Standard No. 80 requirements of authorities having jurisdiction. Provide only items of door hardware that are listed and tested by UL or Warnock Hersey for given type/size opening and degree of label. Provide proper latching hardware, door closers, approved-bearing hinges and seals whether listed in the Hardware Schedule or not. All hardware shall comply with standards UBC 702 (1997) and UL 10C.
   1. Where emergency exit devices are required on fire-rated doors, (with supplementary marking on doors’ UL labels indicating “Fire Door to be equipped with Fire Exit Hardware”) provide UL label on exit devices indicating “Fire Exit Hardware”.

1.7 PRODUCT HANDLING:

A. Tag each item or package separately with identification related to final hardware schedule, and include basic installation instructions with each item or package.

B. Packaging of door hardware is responsibility of supplier. As material is received by hardware supplier from various manufacturers, sort and repackage in containers clearly marked with appropriate hardware set number to match set numbers of approved hardware schedule. Two or more identical sets may be packed in same container.
C. Inventory door hardware jointly with representatives of hardware supplier and hardware installer until each is satisfied that count is correct.

D. Deliver individually packaged door hardware items promptly to place of installation (shop or Project site).

E. Provide secure lock-up for door hardware delivered to the Project, but not yet installed. Control handling and installation of hardware items that are not immediately replaceable so that completion of the Work will not be delayed by hardware losses both before and after installation.

1.8 WARRANTY:

A. All hardware items shall be guaranteed for a period of one year from final acceptance, excepting the following special warranties:
   1. Door Closers: Twenty-five year period
   2. Exit Devices: Ten year period
   3. Locksets: Limited lifetime

1.9 MAINTENANCE:

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

B. Parts kits: Furnish manufacturers' standard parts kits for locksets, exit devices, and door closers.
PART 2 - PRODUCTS

2.1 MANUFACTURED UNITS:
(* Denotes manufacturer referenced in the Hardware Headings)

A. Hinges:
   1. Acceptable manufacturers:
      a. Bommer
      b. McKinney
      c. PBB*
   2. Characteristics:
      a. Templates: Provide only template-produced units.
      b. Screws: Provide Phillips flat-head screws complying with the following requirements:
         1) For metal doors and frames install machine screws into drilled and tapped holes.
         2) For wood doors and frames install threaded-to-the-head wood screws.
         3) For fire-rated wood doors install #12 x 1-1/4 inch, threaded-to-the-head steel wood screws.
         4) Finish screw heads to match surface of hinges or pivots.
      c. Hinge pins: Except as otherwise indicated, provide hinge pins as follows:
         1) Out-Swing Exterior Doors: Non-removable pins.
         2) Out-Swing Corridor Doors with Locks: Non-removable pins.
         3) Interior Doors: Non-rising pins.
         4) Tips: Flat button and matching plug. Finished to match leafs.
      d. Size: Size hinges in accordance with specified manufacturer’s published recommendations.
      e. Quantity: Furnish one pair of hinges for all doors up to 5’0” high. Furnish one hinge for each additional 2-1/2 feet or fraction thereof.

B. Continuous Hinges:
   1. Acceptable manufacturers:
      a. PBB
      b. Select Products*
      c. Zero
   2. Characteristics:
      a. Continuous gear hinges to be manufactured of extruded 6063-T6 aluminum alloy with anodized finish, or factory painted finish as scheduled.
      b. All hinges are to be manufactured to template. Uncut hinges shall be non-handed and shall be a pinless assembly of three interlocking extrusions applied to the full height of the door and frame without mortising.
      c. Vertical door loads shall be carried on 32 each (per 83” hinge) chemically lubricated polyacetal thrust bearings. The door and frame leaves shall be continually geared together for the entire hinge length and secured with a full cover channel. Hinge to operate to a full 180°.
      d. Hinges to be milled then anodized and assembled in matching pairs. Fasteners supplied shall be 410 stainless steel, plated and hardened.
      e. Provide UL listed continuous hinges at fire doors. Continuous hinges at fire doors (suffix -FR) shall meet the required ratings without the use of auxiliary fused pins or studs.

C. Pivot Sets:
1. Acceptable manufacturers:
   a. ABH*
   b. Ives
   c. Rixson

2. Characteristics:
   a. Pivots to be high strength forged bronze with top pivot housing with spring activated bronze retracting pin. Pivots to have tilt-on bearing and bearing pin.

D. Cylinders:
   1. Acceptable manufacturers:
      a. Key Mark* TO MATCH EXISTING SYSTEM
   2. Characteristics:
      a. Review the keying system with the Owner and provide the type required, integrated with the Owner's existing system. Owner to provide permanent cores at project completion.
      b. Equip lockable hardware with housing to accept six pin, SFIC (small format interchangeable core) from Key Mark.
      c. Comply with Owner's instructions for construction keying and temporary cores at selected openings.

E. Locksets, Latchsets, Deadbolts:
   1. Acceptable manufacturers:
      a. Best
      b. PDQ*
      c. Schlage
   2. Mortise Locksets and Latchsets: as scheduled.
      a. Chassis: critical components are brass or corrosion-treated steel.
      b. Latchbolts: 3-4 inch throw brass.
      c. Deadbolt: 1 inch throw, stainless steel.
      d. Lever Trim: accessible design as scheduled.
      e. Electric operation: Manufacturer-installed continuous duty solenoid.
      f. Strikes: Conforms to ANSI 115.2.
      g. Scheduled Lock Series and Design: PDQ MR series, PJSJ trim.
      h. Certifications:
         1) ANSI A156.13, Series 1000, Grade 1

F. Exit Devices:
   1. Acceptable manufacturers:
      a. Detex
      b. PDQ
      c. Von Duprin*
   2. Characteristics:
      a. Exit devices shall be "UL" listed for life safety. All exit devices for fire rated openings shall have "UL" labels for "Fire Exit Hardware."
      b. All exit devices mounted on labeled wood doors shall be mounted on the door per the door manufacturer's requirements.
      c. All trim shall be thru-bolted to the lock stile case.
      d. All exit devices shall be made of brass, bronze, stainless steel, or aluminum material, powder coated, anodized, or plated to the standard architectural finishes to match the balance of the door hardware.
      e. Provide glass bead conversion kits to shim exit devices on doors with raised glass heads.
      f. All exit devices shall be one manufacturer. No deviation will be considered.
Henry County Airport
Hampton, GA

Project No.: 103620
TAG Project No.: 1806

All exit devices shall be non-handed. Touchpad shall extend a minimum of 1/2 of the door width and shall extend to the height of the cross rail housing for a “no pinch” operation. Plastic touchpads are not acceptable. All latchbolts to be the deadlocking type.

Surface vertical rod devices shall be UL labeled for fire door applications without the use of bottom rod assemblies. Where bottom rods are required for security applications, the devices shall be UL labeled for fire doors applications with rod and latch guards by the device manufacturer.

G. Closers and Door Control Devices:
   1. Acceptable manufacturers:
      a. LCN
      b. PDQ*
      c. Sargent
   2. Characteristics:
      a. Door closers shall have fully hydraulic, full rack and pinion action with a high strength cast iron cylinder.
      b. All closers shall utilize a stable fluid withstanding substantial temperature range without seasonal adjustment of closer speed to properly close the door.
      c. Spring power shall be continuously adjustable over the full range of closer sizes, and allow for reduced opening force for the physically handicapped. Hydraulic regulation shall be by tamper-proof, non-critical valves. Closers shall have separate adjustment for latch speed, general speed and back check.
      d. Access-Free Manual Closers: Where manual closers are indicated for doors required to be accessible to the physically handicapped provide adjustable units complying with ADA and ANSI A-117.1 provisions for door opening force.
      e. Closers to be installed to allow door swing as shown on plans. Doors swinging into exit corridors shall provide for corridor clear width as required by code. Where possible, mount closers inside rooms.

H. Overhead Door Holders:
   1. Acceptable manufacturers:
      a. ABH*
      b. Glynn Johnson
      c. Rixson Firemark
   2. Characteristics:
      a. Provide medium duty door holders (concealed and surface mounted) of stainless steel.
      b. Concealed holders to be installed with the jamb bracket mortised flush with the bottom of the jamb. The arm and channel to be mortised into the door.
      c. Surface holders to be installed with the jamb bracket mounted on the stop.

I. Floor Stops and Wall Bumpers:
   1. Acceptable manufacturers:
      a. Burns*
      b. Hiawatha
      c. Trimco
   2. Characteristics: Refer to Hardware Headings.

J. Door Bolts/Coordinators:
1. Acceptable manufacturers:
   a. Burns*
   b. Hiawatha
   c. Trimco

2. Characteristics:
   a. Flush bolts to be forged brass 6-3/4" x 1", with 1/2" diameter bolts. Plunger to be supplied with milled surface one side that fits into a matching guide.
   b. Automatic flush bolts to be UL listed as top and bottom bolts on a pair of classified fire doors. Bolt construction to be of rugged steel and brass components.
   c. Self latching flush bolts to be UL listed as top and bottom bolts on a pair of classified fire doors. Bolt construction to be of rugged steel and brass components.
   d. Automatic flush bolts and self-latching flush bolts shall be UL listed for fire door application without bottom bolts (LBB).
   e. Coordinator to be soffit mounted non-handed fully automatic UL listed coordinating device for sequential closing of paired doors with or without astragals.
   f. Provide filler pieced to close the header. Provide brackets as required for mounting of soffit applied hardware.

K. Protective Plates:
   1. Acceptable manufacturers:
      a. Burns*
      b. Hiawatha
      c. Trimco
   2. Characteristics:
      a. Provide manufacturers standard exposed fasteners for door trim units consisting of either machine screws or self-tapping screws.
      b. Materials:
         1) Metal Plates: Stainless Steel, .050 inch (U.S. 18 gage).
      c. Fabricate protection plates not more than 2 inches less than door width on hinge side and not more than 1 inch less than door width on pull side.
      d. Heights:
         1) Kick plates to be 10 inches in height.
         2) Mop plates to be 4 inches in height.
         3) Armor plates to be 36 inches in height. Armor plates on fire doors to comply with NFPA 80.

L. Thresholds:
   1. Acceptable manufacturers:
      a. National Guard Products, Inc.*
      b. Reese Industries
      c. Zero Weatherstripping Co., Inc.
   2. Types: Indicated in Hardware Headings.

M. Door Seals/Gasketing:
   1. Acceptable manufacturers:
      a. National Guard Products, Inc.*
      b. Reese Industries
      c. Zero Weatherstripping Co., Inc.
   2. Types: Indicated in Hardware Headings.
N. Silencers:
   1. Acceptable manufacturers:
      a. Burns*
      b. Deutscher
      c. Ives
   2. Three for each single doors; four for pairs of doors.

O. Key Cabinet and System:
   1. Acceptable manufacturers:
      a. Lund
      b. MMF
      c. Telkee
   2. Provide a key control system including envelopes, labels, tags with self-locking key clips, receipt forms, 3-way visible card index, temporary markers, permanent markers, and standard metal cabinet, all as recommended by system manufacturer, with capacity for 150 percent of the number of locks required for the Project.
      a. Provide complete cross index system set up by key control distributor, and place keys on markers and hooks in the cabinet as determined by the final key schedule.
      b. Provide hinged-panel type cabinet for wall mounting.

P. Security Equipment:
   1. Acceptable manufacturers:
      a. MS Sedco*
      b. Salto*
      c. Security Door Controls*
   2. Characteristics:
      a. Provide items as found in Hardware Headings.
   3. Coordinate security equipment with Electrical.

2.2 MATERIALS AND FABRICATION:

A. Manufacturer's Name Plate: Do not use manufacturers' products that have manufacturer's name or trade name displayed in a visible location (omit removable nameplates) except in conjunction with required fire-rated labels and as otherwise acceptable to Architect.
   1. Manufacturer's identification will be permitted on rim of lock cylinders only.

B. Base Metals: Produce hardware units of basic metal and forming method indicated, using manufacturer's standard metal alloy, composition, temper, and hardness, but in no case of lesser (commercially recognized) quality than specified for applicable hardware units by applicable ANSI/BHMA A156 series standards for each type of hardware item and with ANSI/BHMA A156.18 for finish designations indicated. Do not furnish "optional" materials or forming methods for those indicated, except as otherwise specified.

C. Fasteners: Provide hardware manufactured to conform to published templates, generally prepared for machine screw installation.
   1. Do not provide hardware that has been prepared for self-tapping sheet metal screws, except as specifically indicated.
   2. Furnish screws for installation with each hardware item. Provide Phillips flat-head screws except as otherwise indicated. Finish exposed (exposed under
any condition) screws to match hardware finish or, if exposed in surfaces of other work, to match finish of this other work as closely as possible including “prepared for paint” surfaces to receive painted finish.

3. Provide concealed fasteners for hardware units that are exposed when door is closed except to the extent no standard units of type specified are available with concealed fasteners.

4. Do not use thru-bolts or sex bolts for installation where bolt head or nut on opposite face is exposed in other work unless their use is the only means of adequately fastening the hardware, or otherwise found in Heading. Coordinate with wood doors and metal doors and frames where thru-bolts are used as a means of reinforcing the work, provide sleeves for each thru-bolt or use sex screw fasteners.

2.3 HARDWARE FINISHES:

A. Match items to the manufacturer’s standard color and texture finish for the latch and lock sets (or push-pull units if no latch of lock sets).

B. Provide finishes that match those established by ANSI or, if none established, match the Architect’s sample.

C. Provide quality of finish, including thickness of plating or coating (if any), composition, hardness, and other qualities complying with manufacturer’s standards, but in no case less than specified by referenced standards for the applicable units of hardware.

D. Provide protective lacquer coating on all exposed hardware finishes of brass, bronze, and aluminum, except as otherwise indicated. The suffix “-NL” is used with standard finish designations to indicate “no lacquer.”

E. The designations used to indicate hardware finishes are those listed in ANSI/BHMA A156.18, “Materials and Finishes,” including coordination with the traditional U.S. finishes shown by certain manufacturers for their products.

1. Hinges (Exterior): 630 (US32D) Satin Stainless Steel
2. Hinges (Interior wood doors): 652 (US26D) Satin Chrome Plated Steel
3. Hinges (Interior metal doors): 600 (USP)
5. Flush Bolts: 626 (US26D) Satin Chrome Plated Brass/Bronze
6. Locks: 630 (US26D) Satin Stainless Steel
7. Exit Devices: Match adjacent hardware
8. Door Closers: Match adjacent hardware
9. Protective Plates: 630 (US32D) Satin Stainless Steel
10. Door Stops: 626 (US26D) Satin Chrome Plated Brass/Bronze
11. Overhead Holders: 630 Satin Stainless Steel

PART 3 - EXECUTION

3.1 INSTALLATION:

A. Mount hardware units at heights indicated in following applicable publications, except as specifically indicated or required to comply with governing regulations and except as otherwise directed by Architect.
1. "Recommended Locations for Builders Hardware for Standard Steel Doors and Frames" by the Door and Hardware Institute.
2. "Recommended Locations for Builders Hardware for Custom Steel Doors and Frames" by the Door and Hardware Institute.

B. Install each hardware item in compliance with the manufacturer's instructions and recommendations. Where cutting and fitting is required to install hardware onto or into surfaces that are later to be painted or finished in another way, coordinate removal, storage, and reinstallation or application of surface protection with finishing work specified in the Division 9 Sections. Do not install surface-mounted items until finishes have been completed on the substrates involved.

C. Set units level, plumb, and true to line and location. Adjust and reinforce the attachment substrate as necessary for proper installation and operation.

D. Drill and countersink units that are not factory prepared for anchorage fasteners. Space fasteners and anchors in accordance with industry standards.

E. Set thresholds for exterior doors in full bed of butyl-rubber or polyisobutylene mastic sealant complying with requirements specified in Division 7 Section "Joint Sealers".

F. Weatherstripping and Seals: Comply with manufacturer's instructions and recommendations to the extent installation requirements are not otherwise indicated.

3.2 ADJUSTING, CLEANING, AND DEMONSTRATING:

A. Adjust and check each operating item of hardware and each door to ensure proper operation or function of every unit. Replace units that cannot be adjusted to operate freely and smoothly or as intended for the application made.
   1. Where door hardware is installed more than one month prior to acceptance or occupancy of a space or area, return to the installation during the week prior to acceptance or occupancy and make final check and adjustment of all hardware items in such space or area. Clean operating items as necessary to restore proper function and finish of hardware and doors. Adjust door control devices to function properly with final operation of heating and ventilating equipment.

B. Clean adjacent surfaces soiled by hardware installation.

C. Door Hardware Supplier's Field Service
   1. Inspect door hardware items for correct installation and adjustment after complete installation of door hardware.
   2. Instruct Owner's personnel in the proper adjustment and maintenance of door hardware and hardware finishes.
   3. File written report of this inspection to Architect.

D. Prior to project completion, representatives of the lock, exit device and overhead closer manufacturers shall inspect and adjust all units and certify that all units are installed in accordance with the manufacturer's instructions, and are regulated.
properly and functioning correctly. A written report shall be provided to the Architect as to the inspection and shall include appropriate certificates.

3.3 HARDWARE SCHEDULE:

**HEADING #A1**

DOORS #: 100A, 102A

EACH PAIR TO HAVE:

1 CYLINDER TO MATCH EXISTING KEYMARK SYSTEM

NOTE: BALANCE OF HARDWARE BY DOOR SUPPLIER.

**HEADING #A2**

DOORS #: 100B, 102B

EACH PAIR TO HAVE:

NOTE: ALL HARDWARE BY DOOR SUPPLIER.

**HEADING #A3**

DOORS #: 104

EACH DOOR TO HAVE:

1 CONTINUOUS HINGE SL11SD
1 DEADLOCK MS1850S X 4066
1 CYLINDER HOUSING BY LOCK SUPPLIER
1 CORE TO MATCH EXISTING KEY MARK SYSTEM
1 PUSH/PULL SET M422 X M39D X TYPE 5/9 MTG.
1 CLOSER 7101 X RAHO X BRACKETS AS REQ.
1 DOOR STOP 522
1 SET DOOR SEALS BY FRAME MANUFACTURER
HEADING #A4

DOORS #: 105, 118

EACH DOOR TO HAVE:

1 CONTINUOUS HINGE SL11SD
1 PUSH/PULL SET M422 X M39D X TYPE 5/9 MTG.
1 CLOSER 7101 X RAHO X BRACKETS AS REQ.
1 DOOR STOP 522
1 SET DOOR SEALS BY FRAME MANUFACTURER

HEADING #A5

DOORS #: 107B, 109

EACH DOOR TO HAVE:

1 CONTINUOUS HINGE SL11HD
1 DEADLOCK MS1850S X 4066
1 CYLINDER HOUSING BY LOCK SUPPLIER
1 CORE TO MATCH EXISTING KEY MARK SYSTEM
1 PUSH/PULL SET M422 X M39D X TYPE 5/9 MTG.
1 CLOSER 7101 X RAHO X BRACKETS AS REQ.
1 DOOR STOP 522
1 SET DOOR SEALS BY FRAME MANUFACTURER
### DOORS #: 121A

Each door to have:

<table>
<thead>
<tr>
<th>Item</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 CONTINUOUS HINGE</td>
<td>SL11HD</td>
</tr>
<tr>
<td>1 ELEC LOCKSET-STAND ALONE</td>
<td>SALTO</td>
</tr>
<tr>
<td>1 CYLINDER HOUSING</td>
<td>BY LOCK SUPPLIER</td>
</tr>
<tr>
<td>1 CORE</td>
<td>TO MATCH EXISTING KEY MARK SYSTEM</td>
</tr>
<tr>
<td>1 PUSH/PULL SET</td>
<td>M422 X M39D X TYPE 5/9 MTG.</td>
</tr>
<tr>
<td>1 CLOSER</td>
<td>7101 X DSHO X BRACKETS AS REQ.</td>
</tr>
<tr>
<td>1 THRESHOLD</td>
<td>513</td>
</tr>
<tr>
<td>1 SET DOOR SEALS</td>
<td>BY FRAME MANUFACTURER</td>
</tr>
<tr>
<td>1 DOOR BOTTOM SEAL</td>
<td>BY DOOR MANUFACTURER</td>
</tr>
</tbody>
</table>

**Note:** Coordinate security hardware with security and electrical system. Ensure electric strike will function properly with power supply. Motion sensor to provide authorized request to exit.

### DOORS #: 121B

Each door to have:

<table>
<thead>
<tr>
<th>Item</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 CONTINUOUS HINGE</td>
<td>SL11HD</td>
</tr>
<tr>
<td>1 PUSH/PULL SET</td>
<td>M422 X M39D X TYPE 5/9 MTG.</td>
</tr>
<tr>
<td>1 CLOSER</td>
<td>7101 X DSHO X BRACKETS AS REQ.</td>
</tr>
</tbody>
</table>
HEADING #A8

DOORS #: 122

EACH DOOR TO HAVE:

1 CONTINUOUS HINGE SL11HD
1 ELEC LOCKSET-STAND ALONE SALTO
1 CYLINDER HOUSING BY LOCK SUPPLIER
1 CORE TO MATCH EXISTING KEY MARK SYSTEM
1 PUSH/PULL SET M422 X M39D X TYPE 5/9 MTG.
1 CLOSER 7101 X DSHO X BRACKETS AS REQ.
1 DOOR STOP 522

NOTE: FINISH TO MATCH DOOR/FRAME. COORDINATE SECURITY HARDWARE WITH SECURITY AND ELECTRICAL SYSTEMS. ENSURE ELECTROMAGNETIC LOCK WILL FUNCTION PROPERLY WITH POWER SUPPLY.

HEADING #1

DOORS #: 107A

EACH DOOR TO HAVE:

1 CONTINUOUS HINGE SL18HD X ATW-8
1 LOCKSET MR199 X SS X SF6L
1 CORE TO MATCH EXISTING KEY MARK SYSTEM
1 ACCESS CONTROL READER SALTO
1 POWER SUPPLY BY SECURITY SYSTEM PROVIDER
1 CLOSER 7101 X DSHO
1 KICK PLATE KP50 X B4E X CSK
1 THRESHOLD 425
1 SET DOOR SEALS 155S
2 DOOR BOTTOM SEALS 200S
1 DRIP CAP 17
1 LATCH GUARD 620

NOTE: COORDINATE SECURITY HARDWARE WITH SECURITY AND ELECTRICAL SYSTEM. ENSURE ELECTRIC STRIKE WILL FUNCTION PROPERLY WITH POWER SUPPLY.
HEADING #2

DOORS #:  110A, 110B

EACH PAIR TO HAVE:

1  SET TRACK HARDWARE      SEE SECTION 08 3616
1  DEADLOCK                 2331
1  CYLINDER HOUSING         BY LOCK SUPPLIER
1  CORE                     TO MATCH EXISTING KEY MARK SYSTEM
4  PULLS                    SEE SECTION 08 3616

NOTE:  SECURED SIDE OF OPENING IS TOWARD CHECKING.

HEADING #3

DOORS #:  111, 113

EACH DOOR TO HAVE:

3  HINGES                   4B81
1  PRIVACY SET W INDICATOR  MR276
1  CLOSER                   7101 X RAHO
1  KICK PLATE               KP50 X B4E X CSK
1  DOOR STOP                565/522 (FLOOR AS REQ.)
1  COAT HOOK                604

HEADING #4

DOORS #:  112

EACH DOOR TO HAVE:

3  HINGES                   BB81
1  PASSAGE SET              MR126
1  DOOR STOP/HOLDER         533/534 (FLOOR AS REQ.)
HEADING #5

DOORS #: 115

EACH DOOR TO HAVE:

3 HINGES 4B81
1 LOCKSET-STOREROOM MR115 X SF6L
1 CORE TO MATCH EXISTING KEY MARK SYSTEM
1 CLOSER 7101 X RAHO
1 KICK PLATE KP50 X B4E X CSK
1 DOOR STOP 565/522 (FLOOR AS REQ.)

HEADING #6

DOORS #: 116A

EACH DOOR TO HAVE:

3 HINGES 4B51 X NRP
1 LOCKSET-STOREROOM MR115 X SF6L
1 CORE TO MATCH EXISTING KEY MARK SYSTEM
1 CLOSER 7101 X DSHO
1 KICK PLATE KP50 X B4E X CSK
1 THRESHOLD 425
1 SET DOOR SEALS 155S
1 DOOR BOTTOM SEAL 200S
1 DRIP CAP 17
1 LATCH GUARD 620
### HEADING #7

**DOORS #:**  116B, 117B

**EACH DOOR TO HAVE:**

<table>
<thead>
<tr>
<th>Item</th>
<th>Quantity</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>HINGES</td>
<td>3</td>
<td>4B81</td>
</tr>
<tr>
<td>LOCKSET-STOREROOM</td>
<td>1</td>
<td>MR115 X SF6L</td>
</tr>
<tr>
<td>CORE</td>
<td>1</td>
<td>TO MATCH EXISTING KEY MARK SYSTEM</td>
</tr>
<tr>
<td>CLOSER</td>
<td>1</td>
<td>7101 X RA</td>
</tr>
<tr>
<td>KICK PLATE</td>
<td>1</td>
<td>KP50 X B4E X CSK</td>
</tr>
<tr>
<td>DOOR STOP</td>
<td>1</td>
<td>565/522 (FLOOR AS REQ.)</td>
</tr>
<tr>
<td>SET DOOR SEALS</td>
<td>1</td>
<td>5075</td>
</tr>
</tbody>
</table>

### HEADING #8

**DOORS #:**  117A

**EACH PAIR TO HAVE:**

<table>
<thead>
<tr>
<th>Item</th>
<th>Quantity</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>HINGES</td>
<td>6</td>
<td>4B51 X NRP</td>
</tr>
<tr>
<td>SET FLUSHBOLTS</td>
<td>1</td>
<td>590 X 545 (INACTIVE)</td>
</tr>
<tr>
<td>LOCKSET-STOREROOM</td>
<td>1</td>
<td>MR115 X SF6L (ACTIVE)</td>
</tr>
<tr>
<td>CORE</td>
<td>1</td>
<td>TO MATCH EXISTING KEY MARK SYSTEM</td>
</tr>
<tr>
<td>CLOSER</td>
<td>1</td>
<td>7101 X DSHO (ACTIVE)</td>
</tr>
<tr>
<td>OVERHEAD HOLDER</td>
<td>1</td>
<td>4424 (INACTIVE)</td>
</tr>
<tr>
<td>KICK PLATES</td>
<td>2</td>
<td>KP50 X B4E X CSK</td>
</tr>
<tr>
<td>THRESHOLD</td>
<td>1</td>
<td>425</td>
</tr>
<tr>
<td>SET DOOR SEALS</td>
<td>1</td>
<td>155S</td>
</tr>
<tr>
<td>DOOR BOTTOM SEALS</td>
<td>2</td>
<td>200S</td>
</tr>
<tr>
<td>DRIP CAP</td>
<td>1</td>
<td>17</td>
</tr>
<tr>
<td>LATCH GUARD</td>
<td>1</td>
<td>620 (ACTIVE)</td>
</tr>
</tbody>
</table>
## HEADING #9

**DOORS #: 119**

**EACH PAIR TO HAVE:**

<table>
<thead>
<tr>
<th>Quantity</th>
<th>Item Description</th>
<th>Specification</th>
</tr>
</thead>
<tbody>
<tr>
<td>6</td>
<td>hinges</td>
<td>4B81</td>
</tr>
<tr>
<td>1</td>
<td>set flushbolts</td>
<td>590 X 545 (INACTIVE)</td>
</tr>
<tr>
<td>1</td>
<td>lockset-classroom</td>
<td>MR148 X SF6L (ACTIVE)</td>
</tr>
<tr>
<td>1</td>
<td>core</td>
<td>TO MATCH EXISTING KEY MARK SYSTEM</td>
</tr>
<tr>
<td>1</td>
<td>closer</td>
<td>7101 X DS (ACTIVE)</td>
</tr>
<tr>
<td>1</td>
<td>overhead holder</td>
<td>4424 (INACTIVE)</td>
</tr>
<tr>
<td>2</td>
<td>kick plates</td>
<td>KP50 X B4E X CSK</td>
</tr>
<tr>
<td>1</td>
<td>set door seals</td>
<td>5075</td>
</tr>
<tr>
<td>1</td>
<td>door edge seal</td>
<td>5070</td>
</tr>
</tbody>
</table>

## HEADING #10

**DOORS #: 120A**

**EACH DOOR TO HAVE:**

<table>
<thead>
<tr>
<th>Quantity</th>
<th>Item Description</th>
<th>Specification</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>continuous hinge</td>
<td>SL18HD</td>
</tr>
<tr>
<td>1</td>
<td>exit device</td>
<td>6200R X 6 GW 03</td>
</tr>
<tr>
<td>1</td>
<td>cylinder housing</td>
<td>BY EXIT DEVICE SUPPLIER</td>
</tr>
<tr>
<td>1</td>
<td>core</td>
<td>TO MATCH EXISTING KEY MARK SYSTEM</td>
</tr>
<tr>
<td>1</td>
<td>closer</td>
<td>7101 X DSHO X SCS-1</td>
</tr>
<tr>
<td>1</td>
<td>aromor plate</td>
<td>AP50 X B4E X CSK</td>
</tr>
<tr>
<td>1</td>
<td>threshold</td>
<td>425HD</td>
</tr>
<tr>
<td>1</td>
<td>set door seals</td>
<td>155S</td>
</tr>
<tr>
<td>2</td>
<td>door bottom seals</td>
<td>200S</td>
</tr>
<tr>
<td>1</td>
<td>drip cap</td>
<td>17</td>
</tr>
<tr>
<td>1</td>
<td>latch guard</td>
<td>620</td>
</tr>
</tbody>
</table>
HEADING #11

DOORS #: 120B, 123

EACH DOOR TO HAVE:

1  SET TRACK HARDWARE  SEE SECTION 08 3616
1  DEADLOCK  1877 (W DUSTPROOF STRIKE IF POSSIBLE)
1  CYLINDER  TO MATCH EXISTING KEY MARK SYSTEM
2  PULLS  SEE SECTION 08 3616

NOTE: SECURED SIDE OF 120B IS FROM MAIN; FROM VENDING FOR 123.

HEADING #12

DOORS #: 125, 126

EACH DOOR TO HAVE:

1  CONTINUOUS HINGE  SL24HD
1  PUSH/PULL SET  74 X 54M26D X TYPE 12 MTG.
1  CLOSER  7101 X RAHO
1  KICK PLATE  KP50 X B4E X CSK
1  MOP PLATE  MP50 X B4E X CSK
1  DOOR STOP  565/522 (AS REQ.)

HEADING #13

DOORS #: 127

EACH DOOR TO HAVE:

3  HINGES  BB81
1  LOCKSET  MR148
1  CORE  TO MATCH EXISTING KEY MARK SYSTEM
1  DOOR STOP  565/522 (FLOOR AS REQ.)
1  MOP PLATE  MP50 X B4E X CSK

END OF SECTION
PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Glass for other sections referencing this Section.
   2. Unframed mirrors

B. Related Sections:
   1. Division 01: Administrative, procedural, and temporary work requirements.
   2. Section 07 9000 – Joint Sealers
   3. Section 08 4113 – Aluminum-Framed Entrances and Storefronts
   4. Section 08 4229 – Automatic Entrances
   5. Section 08 4413 – Glazed Aluminum Curtain Walls

1.2 REFERENCES

A. American Architectural Manufacturers Association (AAMA) 800 - Voluntary Specifications and Test Methods for Sealants.


C. American Society of Civil Engineers (ASCE) (www.asce.org) 7 - Minimum Design Loads for Buildings and Other Structures.

D. ASTM International (ASTM) (www.astm.org):

F. Glass Association of North America (GANA) (www.glasswebsite.com):

G. Insulating Glass Manufacturers Alliance (IGMA) (www.igmaonline.org):
   1. SIGMA TM-3000 - Glazing Guidelines for Sealed Insulating Glass Units.

H. National Fenestration Rating Council (NFRC) (www.nfrc.org):
   1. 100 - Procedure for Determining Fenestration Product Thermal Properties.

1.3 SYSTEM DESCRIPTION

A. Glass Thicknesses:
   1. Indicated thicknesses are minimums; select actual glass thicknesses by analyzing loads and conditions.
   2. Size glass to withstand positive and negative wind pressure acting normal to plane in accordance with ASCE 7 and applicable codes as measured in accordance with ASTM E330.
   3. Provide glass in thicknesses and strengths to meet or exceed following criteria:
      a. Comply with ASTM E1300.
      b. Probability of breakage for vertical glazing: 8 lites per 1000 for lites set within 15 degrees of vertical and under wind load for load duration of 3 seconds.
      c. Thickness of tinted glass: Provide same thickness for each tint color for all applications.

B. Thermal and Optical Performance Properties: Provide glass meeting specified performance properties, based on manufacturer's published test data for units of thickness indicated:
   1. U-factor: Per NFRC 100 expressed as Btu/square foot x hour x degree F.

1.4 SUBMITTALS

A. Product data: Submit for each type of glazing material and accessory product specified. Include technical data, storage and handling procedures and performance characteristics. Mark manufacturer's brochures to include only those products proposed for use.

B. Samples: Submit minimum 1'-0" by 1'-0" samples of each type glazing material proposed for use, if requested by Architect.

C. Framing manufacturer's approval: Prior to submission of shop drawings, indicate by letter that an authorized representative of storefront and curtain wall framing manufacturer has reviewed and approved details, including glass bite, clearances and glazing methods.

D. Calculations: Submit for Architect's information only.
   1. Submit calculations prepared by glazing material manufacturer indicating recommendations for glass thickness and heat treating of glazing materials as a result of heat stress, building orientation, inside window treatments, shading by exterior building components or wind loading.
   2. Identify factors affecting breakage probability which have been taken into consideration and breakage probability anticipated by calculations.
E. Test Report: Preconstruction adhesion and compatibility test report from glazing sealant manufacturer, based on submitted samples or acceptable data from previous testing of current formulations with similar products.

F. Maintenance data: Submit glazing material manufacturer's maintenance data for cleaning and care of each type of glazing material.

1.5 QUALITY ASSURANCE

A. Installer Qualifications: Minimum 5 years experience in work of this Section.

B. Design criteria:
   1. Wind loads: Comply with wind load criteria specified in Aluminum-Framed Entrances and Storefronts and Glazed Curtain Walls sections.
   2. Thermal insulated units: Units shall comply with the requirements of ASTM E2190-08 and be certified by Associated Laboratories, Inc., (ALI) or Insulating Glass Certification Council (IGCC) for Class A.
   3. Glazing materials, whether in monolithic state or as a lite of a thermal insulated unit, shall be heat treated where required by glass manufacturer's design calculations to resist stress caused by glass orientations, sizes and configurations, heat stress, inherent imperfections, wind loading, glazing conditions, temperature differential, inside window treatments or other conditions affecting breakage probability. Maximum allowable breakage probability at design loads shall be eight lites per thousand for vertical glazing.
   4. For heat-treated glass, orient lites with roll distortion parallel to head and sill members.
   5. Tempered, wire and laminated glazing materials shall comply with CPSC 16-CFR, Part 1201, Category II.

C. Allowable tolerances; multiple mirror installations:
   1. Fabrication tolerances:
      a. Variation in mirror dimensions: +/- 1/32".
      b. Variation in square (diagonal measurements): +/- 1/16".
   2. Installation tolerances:
      a. Variation in plumb or square: +/- 1/8" in 10'-0".
      b. Variation in face plane of adjacent mirrors: +/- 1/32".

D. Pre-glazing conference:
   1. Prior to beginning glass and glazing work, a preglazing conference will be held to review work to be accomplished.
   2. Contractor, Architect, storefront, and curtain wall supplier and erector, a representative of glass manufacturer, a representative of sealant manufacturer and glazing subcontractor will be present.
   3. Contractor shall notify all parties at least seven days prior to time of conference.
   4. Review material submitted by Contractor, interfacing of glass and glazing and storefront and curtain wall systems.

1.6 PROJECT CONDITIONS

A. Store glazing materials indoors in cool, dry area, off floor, supported to prevent stress and breakage.

B. Move no cases which have been partially unpacked. Unpack glazing materials in accord with manufacturer's product data for type of material being handled. Stack individual lites as recommended by manufacturer's product data.

C. Utilize rolling blocks to rotate glazing materials.
D. Handle insulated units without rotating, warping or "cartwheeling" units. Prevent damage to glazing material or edge seal.

E. Perform glazing when ambient temperature is above 40 degrees F.

F. Perform glazing on dry surfaces.

1.7 WARRANTIES

A. Glass replacement warranty: Include a two-year warranty covering glazing materials and labor to replace glazing damaged for any reason other than natural disasters, vandalism or damage resulting from accident or abuse arising out of Owner’s operations.

B. Insulating Glass Units: Provide manufacturer’s 10 year warranty against material obstruction of vision through unit due to:
   1. Intrusion of dust or moisture.
   2. Internal condensation.
   3. Film formation on internal glass surfaces caused by failure of hermetic seal except failure caused in whole or in part by breakage or fracturing of any portion of glass surface.

C. Glass Coatings: Provide manufacturer’s 10 year warranty against peeling, cracking, or deterioration of coating under normal conditions.

D. Mirrors: Provide manufacturer’s 10 year warranty against silver spoilage resulting from manufacturing defects.

E. Warranties commence at Date of Material Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Acceptable Manufacturers - Glass:
   2. Guardian Industries Corp. (www.guardian.com)
   3. Oldcastle Building Envelope. (www.oldcastlebe.com)
   5. Viracon, Inc. (www.viracon.com)

2.2 FLAT GLASS MATERIALS

A. Clear Tempered Glass (C-2):
   1. Comply with ASTM C 1048, Type I, transparent flat, Class 1 clear, Quality Q3 (glazing select), Kind FT fully tempered.
   2. Thickness: 1/4 inch.

B. Ultra-Clear Glass (UC-1):
   2. Comply with ASTM C 1036, Type I, transparent flat, Class 2 tinted heat absorbing and light reducing, Quality Q3 (glazing select).
   3. Thickness: 1/4 inch.

C. Ultra-Clear Tempered Glass (UC-2):
2. Comply with ASTM C 1048, Type I, transparent flat, Class 2 tinted heat absorbing and light reducing, Quality Q3 (glazing select), Kind FT fully tempered.

3. Thickness: 1/4 inch.

D. Ultra-Clear Heat Strengthened Glass (UC-3):
   2. Comply with ASTM C 1048, Type I, transparent flat, Class 2 tinted heat absorbing and light reducing, Quality Q3 (glazing select), Kind HS heat strengthened.
   3. Thickness: 1/4 inch.

E. Mirror Glass (M-1):
   1. ASTM C 1036, Type 1 transparent flat, Class 1 clear, Quality Q1 (mirror select).
   2. Thickness: 1/4 inch.

2.3 SEALED INSULATING GLASS MATERIALS

A. General Requirements:
   1. Comply with ASTM E 774 and E 773, Class CBA.
   2. Purge interpane space with dry hermetic air.
   3. Provide heat strengthened units where required for thermal safety and structural integrity.

B. Ultra-Clear Insulating Low-E Glass Units (I-1): Double pane with glass to elastomer edge seal.
   1. Outer pane of ultra-clear glass, inner pane of ultra-clear glass.
   2. Low-E Coating: Place low-e coating on No. 2 surface within the unit.
      a. Basis of design: Solarban 60 (2) by Vitro Architectural Glass.
   3. Maximum Winter U-Value of unit: 0.29.
   4. Maximum SHGC of 0.41.
   5. Minimum Visible Light Transmittance: 73%
   6. Total unit thickness of 1 inch minimum.

C. Ultra-Clear Insulating Low-E Tempered Glass Units (I-2): Double pane with glass to elastomer edge seal.
   1. Outer pane of ultra-clear glass, inner pane of ultra-clear glass.
   2. Low-E Coating: Place low-e coating on No. 2 surface within the unit.
      a. Basis of design: Solarban 60 (2) by Vitro Architectural Glass.
   3. Maximum Winter U-Value of unit: 0.29.
   4. Maximum SHGC of 0.41.
   5. Minimum Visible Light Transmittance: 73%
   6. Total unit thickness of 1 inch minimum.

2.4 ACCESSORIES

A. Setting Blocks: ASTM C864, neoprene or EPDM, or ASTM C1115, silicone; 80 to 90 Shore A durometer hardness.

B. Spacers:
   1. Manufacturer's standard steel or aluminum spacer with welded, soldered, fused or bent corners and welded, soldered or fused splices and joints, filled with desiccant; to provide a 1/2" thickness, hermetically sealed, dehydrated air space.
   2. Color: Black

C. Glazing Gaskets:
   1. Dense compression gaskets: ASTM C864, neoprene or EPDM, or ASTM C1115, silicone or thermoplastic polyolefin rubber, molded or extruded shape to fit glazing channel retaining slot; black color.
2. Soft compression gaskets: ASTM C509, Type II, black, molded or extruded, neoprene, EPDM, silicone or thermoplastic polyol rubber, of profile and hardness required to maintain watertight seal; black color.

D. Contact Sealant:
   1. Type: Single component, medium modulus, neutral moisture curing silicone sealant; ASTM C1184 and ASTM C920, Type S, Grade NS, Class 25, Use NT, M, G and A.
   3. Compatible with glass unit edge seals; tested to ASTM C1294.

E. Weatherseal Sealant:
   1. Type: Single component, low modulus, neutral moisture curing silicone sealant; ASTM C920, Type S, Grade NS, Class 25, Use NT, M, G and A.
   3. Compatible with glass unit edge seals; tested to ASTM C1294.

F. Butt Joint Glazing Sealant:
   1. Type: Single component, low modulus type, non sag, ASTM C920, Type S, Grade NS, Class 25.
   2. Compatible with glass unit edge seals; tested to ASTM C1294.

G. Glazing Sealant:
   1. Type: Single component silicone, low modulus, non sag ASTM C920, Type S, Grade NS, Class 25.
   2. Compatible with glass unit edge seals; tested to ASTM C1294.

H. Sealant Backing: ASTM C1330, Type O, size and density to control glazing sealant depth and produce optimum glazing sealant performance.

I. Primer: As recommended by glazing sealant manufacturer.

J. Mirror Adhesive: Adhesive setting compound, produced specifically for setting mirrors by spot application method.

2.5 FABRICATION

A. Annealed Glass: Comply with ASTM C1036.

B. Tempered Glass:
   2. Process in horizontal position so that inherent roller distortion will run parallel to building floor lines after installation.

C. Sealed Insulating Glass:
   2. Fabricate spacer bar frame of tubular aluminum filled with desiccant.
   3. Bond spacer bar frame to glass panes with twin primary seals.
   4. Fill space outside frame to glass edge with elastomeric sealant.

D. Low-E Coated Glass: Apply low-emissivity coating to scheduled glass surface.

E. Mirror Glass:
   1. Apply one coat of silver, one coat of electroplated copper, and one coat of organic
mirror backing compound to back surface of glass.
2. Ease and polish edges.

F. Fabrication Tolerances: ASTM C1036 and ASTM C1048.

G. Glass Identification:
   1. Apply manufacturer's label indicating type and thickness to each light of glass. Show position of exterior face when installed, where applicable.
   2. Etch manufacturer's label on each light of tempered glass.

H. Source Quality Control:
   1. Preconstruction adhesion and compatibility testing:
      a. Perform adhesion test including ultraviolet exposure through glass on production samples of metals and glass in accordance with ASTM C794.
      b. Test glass units, glazing materials, and glass framing members with specified finish for sealant compatibility, priming, and preparation requirements for optimum adhesion and performance.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify compliance with the following requirements prior to beginning glazing work:
   1. That framing is anchored in position, plumb and square within 1/8" of nominal dimensions indicated.
   2. That fastener heads, and other projections are removed from glazing rabbets.
   3. That corners and fabrication intersections are sealed and framing is weathertight.
   4. That rabbets at sills weep to outside and rabbets are of sufficient depth and width to receive glazing material and provide the required bite of the glazing material.

3.2 PERFORMANCE REQUIREMENTS

A. Install glazing materials to obtain airtight and watertight installation and to withstand normal temperature changes and wind loads without failure.

B. Protect glazing material faces and edges during handling and installation.

C. Size glazing materials for each opening to ensure correct bite on glazing material, without imposing strain, in accord with manufacturer's product data.

D. Maintain minimum bed clearance between glazing material and sash of 1/8", both sides, except where greater clearance is required by either glazing material or framing manufacturer.

3.3 PREPARATION OF SURFACES

A. Clean glazing rabbets; remove loose and foreign matter.

B. Remove protective coatings on metal surfaces.

C. Clean glass just prior to installation.

D. Clean glass edges and framing glazing channel of debris and protective coatings immediately prior to glazing. Use material acceptable to framing, glazing material and glazing sealant manufacturers.

E. Inspect glazing material prior to installation. Eliminate lites having face or edge damage.
F. Lites of tempered and insulated glass shall not be cut or otherwise altered in the field.

3.4 INSTALLATION - GENERAL

A. Install glass in accordance with glass manufacturer's instructions.

B. Maintain manufacturer's recommended edge and face clearances between glass and frame members.

C. Install setting blocks for glazing materials over six sq. ft. in area. Install at sill rabbet at quarter points. Size setting blocks in proportion to glass weight; minimum 4" length.

D. Shim lites over 100 united inches, inboard and outboard, on all sides using continuous shims, except where gaskets accomplish shimming.

E. Provide edge blocks at vertical jambs to prevent lateral movement of glass. Provide edge blocks at 3" minimum length. Maintain 1/8" clearance between edge of glass and edge block.

3.5 INSTALLATION - STRUCTURAL SILICONE GLAZING METHOD

A. Mask aluminum and glass surfaces adjacent to sealant pockets.

B. Install temporary glass retainers to align faces of glass.

C. Apply contact sealant; completely fill pockets. Tool joints and remove masking tape before sealant skim cure begins.

D. Allow sealant to cure minimum time required by manufacturer.

E. Remove temporary glass retainers.

F. Insert joint backing to fill void between glass unit edges and glass spacer.

G. Mask both sides of glass for full length of joint.

H. Apply weatherseal sealant; tool to smooth, slightly concave profile.

3.6 INSTALLATION - SILICONE GLAZING METHOD

A. Mask both sides of joint for full length.

B. Install temporary glass retainers to align faces of glass.

C. Provide temporary joint backing for one side of joint.

D. Apply sealant to completely fill spaces; tool to smooth, slightly concave surface.

E. Allow sealant to cure minimum time required by manufacturer. Remove temporary backing and fill voids with additional sealant.

3.7 INSTALLATION - GASKET GLAZING METHOD

A. Fabricate gaskets to fit openings; allow for stretching of gaskets during installation.

B. Set soft compression gasket against fixed stop or frame with bonded miter cut joints at corners.
C. Set glass centered in openings on setting blocks.

D. Install removable stops and insert dense compression gaskets at corners, working toward centers of glass, compressing glass against soft compression gaskets to produce weathertight seal.

E. Seal joints in gaskets.

F. Allow gaskets to protrude past face of glazing stops.

3.8 INSTALLATION - PRESSURE GLAZING METHOD

A. Set glass unit in opening as recommended by system manufacturer.

B. Tighten fasteners simultaneously at rate recommended by manufacturer to avoid unequal point pressures on glass.

C. Torque fasteners to achieve required pressure against glass. Do not over tighten.

3.9 INSTALLATION - SEALANT GLAZING METHOD

A. Apply sealant to full depth of permanent stops.

B. Press glass into sealant with slight lateral movement to ensure adhesion.

C. Apply sealant to full depth of removable stops. Secure stops in position, forcing contact with sealant bead and completely filling joint.

1.10 INSTALLATION - MIRRORS

A. Apply mirror adhesive in accordance with manufacturer's instructions to cover maximum 25 percent of back of mirror. Set mirror and press against substrate to ensure adhesive bond.

B. Leave minimum 1/8 inch open ventilation space between mirror and substrate over 75 percent of mirror area. Do not seal off ventilation space at edges.

C. Place plumb and level without distortion.

3.11 PROTECTION

A. For glazing materials subject to damage during construction, protect from breakage by attachment of crossed streamers to framing. Do not mark on surfaces.

B. Remove and replace broken, cracked, chipped or otherwise damaged glazing materials and materials not meeting specified design criteria prior to Date of Substantial Completion.

C. Final cleaning: Just prior to Date of Substantial Completion, clean glass inside and out. Clean using pre-tested detergent and water. Flush with clean water. Repair or replace work which cannot be cleaned or which has been damaged during construction operations.
# APPENDIX – SCHEDULE OF SUBMITTALS

<table>
<thead>
<tr>
<th>Submittal Number</th>
<th>Item Number</th>
<th>Description</th>
<th>Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td>08 8000</td>
<td></td>
<td><strong>Glazing</strong></td>
<td></td>
</tr>
<tr>
<td></td>
<td>088000-1.4-A-01</td>
<td>Product Data – Glass Type C-2</td>
<td>Provide only if requested by Architect</td>
</tr>
<tr>
<td></td>
<td>088000-1.4-A-02</td>
<td>Product Data – Glass Type UC-1</td>
<td></td>
</tr>
<tr>
<td></td>
<td>088000-1.4-A-03</td>
<td>Product Data – Glass Type UC-2</td>
<td></td>
</tr>
<tr>
<td></td>
<td>088000-1.4-A-04</td>
<td>Product Data – Glass Type UC-3</td>
<td></td>
</tr>
<tr>
<td></td>
<td>088000-1.4-A-05</td>
<td>Product Data – Glass Type M-1</td>
<td>Provide only if requested by Architect</td>
</tr>
<tr>
<td></td>
<td>088000-1.4-A-06</td>
<td>Product Data – Unit Type I-1</td>
<td></td>
</tr>
<tr>
<td></td>
<td>088000-1.4-A-07</td>
<td>Product Data – Unit Type I-2</td>
<td></td>
</tr>
<tr>
<td></td>
<td>088000-1.4-A-08</td>
<td>Product Data – Setting Blocks</td>
<td></td>
</tr>
<tr>
<td></td>
<td>088000-1.4-A-09</td>
<td>Product Data - Spacers</td>
<td></td>
</tr>
<tr>
<td></td>
<td>088000-1.4-A-10</td>
<td>Product Data – Glazing Gaskets</td>
<td></td>
</tr>
<tr>
<td></td>
<td>088000-1.4-A-11</td>
<td>Product Data – Contact Sealant</td>
<td></td>
</tr>
<tr>
<td></td>
<td>088000-1.4-A-12</td>
<td>Product Data – Weatherseal Sealant</td>
<td></td>
</tr>
<tr>
<td></td>
<td>088000-1.4-A-13</td>
<td>Product Data - Butt Joint Glazing Sealant</td>
<td></td>
</tr>
<tr>
<td></td>
<td>088000-1.4-A-14</td>
<td>Product Data – Glazing Sealant</td>
<td></td>
</tr>
<tr>
<td></td>
<td>088000-1.4-A-15</td>
<td>Product Data – Sealant Backing</td>
<td></td>
</tr>
<tr>
<td></td>
<td>088000-1.4-A-16</td>
<td>Product Data - Primer</td>
<td></td>
</tr>
<tr>
<td></td>
<td>088000-1.4-A-17</td>
<td>Product Data – Mirror Adhesive</td>
<td></td>
</tr>
<tr>
<td></td>
<td>088000-1.4-B-01</td>
<td>Samples - Glass Type C-2</td>
<td>Provide only if requested by Architect</td>
</tr>
<tr>
<td></td>
<td>088000-1.4-B-02</td>
<td>Samples - Glass Type UC-1</td>
<td>Provide only if requested by Architect</td>
</tr>
<tr>
<td></td>
<td>088000-1.4-B-03</td>
<td>Samples - Glass Type UC-2</td>
<td>Provide only if requested by Architect</td>
</tr>
<tr>
<td>Item Code</td>
<td>Description</td>
<td>Requirements</td>
<td></td>
</tr>
<tr>
<td>-----------------</td>
<td>--------------------------------------------------</td>
<td>--------------------------------------------------</td>
<td></td>
</tr>
<tr>
<td>088000-1.4-B-04</td>
<td>Samples - Glass Type UC-3</td>
<td>Provide only if requested by Architect</td>
<td></td>
</tr>
<tr>
<td>088000-1.4-B-05</td>
<td>Samples - Glass Type M-1</td>
<td>Provide only if requested by Architect</td>
<td></td>
</tr>
<tr>
<td>088000-1.4-B-06</td>
<td>Samples - Glass Units I-1</td>
<td>Requested by Architect only if not providing basis of design items</td>
<td></td>
</tr>
<tr>
<td>088000-1.4-B-07</td>
<td>Samples - Glass Units I-2</td>
<td>Requested by Architect only if not providing basis of design items</td>
<td></td>
</tr>
<tr>
<td>088000-1.4-C-01</td>
<td>Framing Manufacturer’s Approval</td>
<td></td>
<td></td>
</tr>
<tr>
<td>088000-1.4-D-01</td>
<td>Calculations</td>
<td></td>
<td></td>
</tr>
<tr>
<td>088000-1.4-E-01</td>
<td>Test Report</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td><strong>Project Close-Out Submittal</strong></td>
<td><strong>Provide at date of material completion</strong></td>
<td></td>
</tr>
<tr>
<td>088000-1.4-F-01</td>
<td>Maintenance Data</td>
<td></td>
<td></td>
</tr>
<tr>
<td>088000-1.7-A-01</td>
<td>Glass Replacement Warranty</td>
<td></td>
<td></td>
</tr>
<tr>
<td>088000-1.7-B-01</td>
<td>Insulating Glass Units Warranty</td>
<td></td>
<td></td>
</tr>
<tr>
<td>088000-1.7-C-01</td>
<td>Glass Coatings Warranty</td>
<td></td>
<td></td>
</tr>
<tr>
<td>088000-1.7-D-01</td>
<td>Mirror Warranty</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

END OF SECTION
SECTION 08 9100
LOUVERS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Fixed louvers and frames.
   2. Insect screens.

B. Related Sections:
   1. Division 01 - Administrative, procedural, and temporary work requirements.
   2. Section 04 2113 – Brick Masonry

1.2 REFERENCES


B. American Architectural Manufacturers Association (AAMA):
   1. 611 - Voluntary Specification for Anodized Architectural Aluminum.
   2. 621 - Voluntary Specifications for High Performance Organic Coatings on Coil Coated Architectural Hot Dipped Galvanized (HDG) and Zinc-Aluminum Coated Steel Substrates.

C. American Society of Civil Engineers (ASCE) 7 - Minimum Design Loads for Buildings and Other Structures.

D. ASTM International (ASTM):
   1. A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.

1.3 SUBMITTALS

A. Shop Drawings: Include locations, elevations, sections, dimensions, materials, finishes, attachment, and relationship to adjacent construction.

B. Product data: Indicate material types, finishes and sizes, fabrication and installation details. Mark manufacturer's brochures to include only those products proposed for use.

   1. Performance Requirements: Bear AMCA Certified Ratings Seal for air performance.

1.4 PROJECT/SITE CONDITIONS:

A. Protection: Protect pre-finished surfaces from damage and staining. Provide protective covering for louvers during subsequent construction.
B. Coordinate installation of louvers to be built into building structure. Secure templates and lay out to rough dimensions furnished by manufacturer.

PART 2 - PRODUCTS

2.1 LOUVERS

A. Acceptable manufacturers; subject to compliance with specified requirements:
   3. The Airolite Co. (www.airolite.com)
   5. Industrial Louvers, Inc. (www.industrialouvers.com)

B. Characteristics:
   1. Type: Stationary 6" deep.
   2. Material: 6063-T5 aluminum alloy, meeting ASTM B221-08, 0.081" minimum thickness.
   5. Free area: 50%.
   6. Finish:
         2) Minimum coating thickness: 0.70 mils, tested in accord with ASTM B244-97(2002).
   7. Screening: 16 by 18 mesh aluminum insect screen in extruded aluminum frame.

C. Concealed mullions: Provide as indicated on approved shop drawings, of same material and finish as louvers.

D. Sill pieces: Form of same material and finish as louvers.

E. Accessory products:
   1. Fasteners: Stainless steel of type required to attach to substrates encountered.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install louvers in accord with manufacturer's instructions, product data, and approved shop drawings.

B. Set plumb, level, and rigid, with flush hairline joints.

C. Anchor to supporting construction.

D. Prevent contact of aluminum and dissimilar metals, concrete, stucco and masonry by use of zinc rich paint, bituminous coating, or non-absorptive gaskets.

E. Attach louvers using stainless steel fasteners spaced at 1'-0" o. c., at head, sill and jambs.
F. Install screen on inside face.

G. Install blank out sheeting over interior side of unused portions of louver.

3.2 ADJUSTING

A. Touch up minor scratches and abrasions in finish coat to match factory finish.

APPENDIX – SCHEDULE OF SUBMITTALS

<table>
<thead>
<tr>
<th>Submittal Number</th>
<th>Item Number</th>
<th>Description</th>
<th>Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td>08 9100</td>
<td></td>
<td>Louvers</td>
<td></td>
</tr>
<tr>
<td></td>
<td>089100-1.3-A-01</td>
<td>Shop Drawings - Louvers</td>
<td></td>
</tr>
<tr>
<td></td>
<td>089100-1.3-B-01</td>
<td>Product Data - Louvers</td>
<td></td>
</tr>
<tr>
<td></td>
<td>089100-1.3-C-01</td>
<td>Performance Data - Louvers</td>
<td></td>
</tr>
</tbody>
</table>

END OF SECTION
PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Acoustical insulation.
   2. Gypsum board.
   3. Cementitious panels.
   4. Taping and bedding of gypsum board.

B. Related Sections:
   1. Division 01 - Administrative, procedural, and temporary work requirements.
   2. Section 06 1000 – Rough Carpentry
   3. Section 07 9200 – Joint Sealers
   4. Section 09 9000 – Painting

1.2 REFERENCES

A. American National Standards Institute (ANSI):
   1. A108.11 - Interior Installation of Cementitious Backer Units.
   2. A118.9 - Test Methods and Specifications for Cementitious Backer Units.

B. ASTM International (ASTM):

C. Gypsum Association (GA):
   2. GA-216 - Recommended Specifications for the Application and Finishing of Gypsum Board.

D. Underwriters Laboratories, Inc. (UL) - Fire Resistance Directory.

1.3 SUBMITTALS

A. Product Data: Illustrate panel product types, thicknesses, and locations; acoustical insulation; and accessories. Mark manufacturer's brochures to include only those products proposed for
1.4 QUALITY ASSURANCE

A. Fire Resistance Ratings:
   1. Construct assemblies to achieve fire resistance ratings indicated on Drawings, in accordance with referenced UL design number.
   2. If requirements of assembly numbers referenced conflict with Contract Document requirements, conform to assembly requirements.

B. Acoustic Ratings: Construct assemblies to achieve acoustic ratings indicated on Drawings, tested to ASTM E90 and classified in accordance with ASTM E413.

C. Gypsum board materials shall be the products of one manufacturer.

D. Framing member materials shall be the products of one manufacturer.

1.5 DELIVERY, STORAGE AND HANDLING

A. Delivery: Deliver materials in original packages, containers or bundles bearing brand name, applicable standard designation and name of manufacturer or supplier.

B. Storage:
   1. Stack gypsum board inside building under roof, off floor on pallets or similar platforms providing continuous support for gypsum board and to prevent sagging. Stack gypsum board flat and so that long lengths are not over short lengths.
   2. Protect gypsum board from direct exposure to rain, snow, sunlight or other excessive weather conditions.
   3. Protect ready-mixed joint compounds against freezing, exposure to extreme heat and direct sunlight at all times.
   4. Do not overload floor systems.

1.6 PROJECT SITE CONDITIONS

A. Install gypsum board only after building is enclosed.

B. Environmental conditions:
   1. During mechanical application of gypsum board, maintain room temperature at not less than 40 degree F.
   2. During adhesive application of gypsum board, joint treatment, and decoration, maintain room temperature not less than 50 degrees F for 48 hours prior to application and continuously thereafter until completely dry and until permanent heating system is in operation or building is occupied.
   3. When temporary heat source is used, temperature shall not exceed 95 degree F in any given room or area.

C. Ventilation:
   1. Provide ventilation during and following joint treatment applications, and drying and curing periods.
   2. Use temporary air circulators in enclosed areas lacking natural ventilation.
   3. Under slow drying conditions, allow additional drying time between coats of joint treatment.
   4. Protect installed materials from drafts during hot, dry weather.

D. When recommendations of manufacturer’s product data exceed the above, comply with requirements of manufacturer’s product data.
PART 2 - PRODUCTS

2.1 FRAMING MEMBERS

A. Acceptable Manufacturers – Gypsum Board Studs:
   1. ClarkDietrich Building Systems, LLC. (www.clarkdietrich.com)
   2. MarinoWare (www.marinoware.com)

B. Substitutions: Under provisions of Division 01.

C. Gypsum board studs: Meeting requirements of ASTM C645-09a; channel type, roll-formed from hot dip galvanized steel complying with ASTM A1003-09 and with ASTM A653-09a, G40 minimum.
   1. Stud size: As indicated on drawings, except minimum 3-5/8" depth where partition is indicated to receive tile finish.
   2. Stud gauge: Minimum 20 gage and heavier as required by manufacturer’s product data for heights and conditions of use, with maximum allowable deflections as follows:
      a. Stairs and other vertical shafts: L/120 at 10 psf.
      b. Ground floor lobbies: L/120 at 15 psf.
      c. Partitions to receive tile and FRP panels finish: L/360 at 15 psf.
      d. All other partitions: L/240 at 5 psf.
      e. Minimum stud gage is actual thickness. “Equivalent” thickness is not acceptable.

D. Floor and ceiling runners: Hot dip galvanized steel, 1" deep, minimum, by widths to receive studs, same gauge as studs. Runner tracks shall have slotted holes for attachment to structure and studs, for slip joints where required by manufacturer’s product data.

2.2 GYPSUM BOARD

A. Acceptable Manufacturers - Gypsum Panels:
   1. CertainTeed Gypsum, Inc. (www.certainteed.com)
   2. GP Gypsum Corporation. (www.gp.com)
   4. USG Corporation. (www.usg.com)

B. Substitutions: Under provisions of Division 01.

C. Regular Gypsum Board: ASTM C1396; 48 inches wide x thickness indicated, maximum practical length, tapered edge.

D. Abuse-Resistant Gypsum Board: ASTM C1396 and ASTM C1629, Classification Level 2; 48 inches wide x 5/8 inch thick, maximum practical length, tapered edge; apply to walls where indicated.

E. Fire Resistant Gypsum Board: ASTM C1396, Type X; 48 inches wide x thickness indicated, maximum practical length, tapered edge; apply to fire rated assemblies.

F. Water Resistant Abuse-Resistant Gypsum Tile Backerboard: ASTM C1278 and ASTM C1629; 48 inches wide x thickness indicated, maximum practical length, water resistant; apply to walls to receive tile, walls adjacent to sinks, and walls in janitor closets and toilet rooms.

G. Fire Resistant, Water Resistant Abuse-Resistant Gypsum Tile Backerboard: ASTM C1278 and ASTM C1629; Type X; 48 inches wide x thickness indicated, maximum practical length, water resistant; apply to fire rated walls to receive tile, fire rated walls adjacent to sinks, and fire rated walls in janitor closets and toilet rooms.
2.3 FASTENERS

A. Fasteners for metal framing, corrosion-resistant:
   1. For fastening framing members to concrete and masonry surfaces: Fasteners shall be beaded drive pins or threaded studs driven by powder actuated tools. Fasteners shall resist design loads in accord with requirements of ASTM E1190-95.
   2. For fastening to metal decking and for fastening framing members together: Type S, pan head screws, in sizes recommended by gypsum board manufacturer for applications indicated.
   3. Provide slotted, stand-off washers for slip joint attachments.

2.4 JOINT MATERIALS

A. Standard gypsum board products:
   2. Joint compound: Meeting ASTM C475-02, ready-mixed tape embedment and topping compounds, vinyl-based.

B. Joint materials shall be the products of the gypsum board manufacturer.

C. Joint tape and joint compound shall be in accord with recommendations of gypsum board manufacturer’s product data.

2.5 SUSPENDED GYPSUM BOARD FURRING SYSTEM

A. Acceptable manufacturers:
   1. Armstrong World Industries, Inc.
   2. Chicago Metallic Corp.
   3. USG Interiors, Inc.

B. Substitutions: Under provisions of Division 01.

C. Characteristics:
   2. Components: Fabricated from minimum 0.020” thickness, galvanized, cold-rolled steel; double web design.

2.6 ACCESSORIES

A. Accessories shall comply with ASTM C1047-09 and shall be as follows.

B. Corner reinforcement, control joints, and metal jamb, ceiling & casing trim:
   1. Corner reinforcement: Galvanized steel with 1-1/4” wide fine expanded mesh flanges.
   2. Control joints: Roll-formed galvanized steel.
   3. Metal jamb, ceiling and casing trim: Manufacturer’s standard "L" and "U" shaped galvanized members with fine expanded mesh flanges; "mud-in" type for finishing with joint compound.

C. Resilient channel: Galvanized steel, manufacturer’s standard type.

D. Furring brackets: Minimum 20 ga. galvanized steel, for attaching 3/4” furring channels to masonry walls.

E. Ceiling hangers: Minimum eight ga. galvanized annealed steel wire.

F. Tie wire: Minimum 18 gage, galvanized, annealed steel wire.
G. Acoustical Sealer: Specified in Section 07 9200.


PART 3 - EXECUTION

3.1 FRAMING AND FURRING INSTALLATION

A. Except where more stringent requirements are specified, install framing and furring in accord with ASTM C754-09a, Gypsum Association requirements and manufacturer’s product data.

B. Runners:
   1. Attach runner tracks at floor and underside of structural deck with specified fasteners. Provide slip joint attachments to meet deflection criteria and manufacturer’s calculations at the following locations:
      a. Tall partitions.
      b. Full-height, floor-to-floor or floor-to-deck partitions.
      c. All partitions subject to deflection.
   2. Where partitions are indicated to stop at finish ceiling, attach to ceiling suspension system using 1/8” toggle bolts or sheet metal screws spaced at 1'-4" o. c., maximum, where partition aligns with ceiling grid. Where partition does not align with grid, attach at each intersection with grid.

C. Studs:
   1. Position full length studs vertically, engaging floor and ceiling runners.
      a. Space studs as indicated on drawings.
      b. Space studs not to exceed 1'-4".
   2. Provide double studs at interior and exterior corners, expansion joints, partition termination and adjacent to door and borrowed lite openings in partitions. Locate next stud not more than 6" from double studs.
   3. Secure abutting and intersecting walls with fasteners through stud flanges.
   4. For horizontal reinforcement at door and borrowed lite frames, install cut-to-length runner sections with slit flanges secured to studs.
   5. Install acoustical tape on metal studs which abut other studs or dissimilar surfaces in walls to receive sound attenuation blankets.

D. At locations of stair handrails attached to metal-framed gypsum board partitions, provide minimum 20 ga. steel plate, set at handrail height and rise, for handrail bracket attachment. Attach to metal framing, full length of handrail.

3.2 SUSPENDED GYPSUM BOARD FURRING SYSTEM INSTALLATION

A. Install suspension system in accord with ASTM C754-09a.

B. Seismic bracing: Comply with details and spacing indicated on drawings.

C. Hangers:
   1. Space hangers at 4'-0" o. c., maximum, in each direction. Secure to building structure.
   2. Install additional hangers at ends of each suspension member and at each corner of lighting fixtures.
   3. Splay wires no more than 5" in 4'-0" vertical drop.
   4. Wrap wire minimum of three times horizontally, turning ends upward.

D. Space main tees at 4'-0" o. c., perpendicular to structure. Space cross tees at 2'-0" o. c., perpendicular to main tees to form 2'-0" by 4'-0" grid system.
E. Level and square suspension system within specified tolerances.

F. Where grid system exists in an unrestrained condition, brace back to building structure using hanger wire, main tee or carrying channel braces spaced at 4'-0" o. c., maximum.

3.3 GENERAL GYPSUM BOARD APPLICATION

A. Except where more stringent requirements are specified, install gypsum board in accord with ASTM C840-08, GA-216 and manufacturer=s product data.

B. Use gypsum board of maximum lengths to minimize end joints. Stagger end joints.

C. Abut gypsum boards without forcing. Fit ends and edges of board. Do not place butt ends against tapered edges.

D. Support ends and edges of gypsum board panels on framing or furring members, except for face layer of double layer work.

E. Install gypsum board accessories in accord with gypsum board manufacturer=s product data and as follows:
   1. Control joints:
      a. Install in walls and ceilings in accord with requirements of ASTM C 840-08 and in specific locations approved by Architect for visual effect.
      b. Install control joints at walls and partitions:
         1) At changes in backup material.
         2) At maximum 30 feet o.c.
         3) Above both jambs of openings in partitions
      c. Install control joints at ceilings:
         1) Where ceiling framing changes direction.
         2) At maximum 50 feet o.c.
      d. Attach with staples to panel face.
      e. Where control joints occur in fire rated partitions, comply with code requirements and gypsum board manufacturer=s product data.
   2. Corner bead: Install at external corners.
   3. Metal trim shapes: At exposed edge of gypsum board at door and window openings, at intersections with other materials and at intersection of walls with ceilings.
   4. Install corner beads and metal trim shapes to framing system with mechanical anchors.

F. Install acoustical sealant at sound-rated partitions:
   1. Seal partition perimeter with continuous 1/4" minimum round bead of acoustical sealant applied to each leg of runners, including those used at partition intersections with dissimilar wall construction.
   2. Install gypsum board with 1/8" perimeter relief compressing sealant to form permanent airtight seal.
   3. Where slip joint attachments are required at top of partition, fill resulting joint between drywall and adjacent structure with acoustical sealant to form permanent air tight seal.
   4. Apply acoustical sealant around cutouts such as at electrical boxes, plumbing penetrations, medicine cabinets, heating ducts and cold air returns to form permanent airtight seal. (Sealant shall not be used as a fire stopping material.)

G. Install sound attenuation blankets at locations indicated on drawings. Comply with manufacturer=s product data for installation. Attach flanges of blanket to web of stud and not to face of stud receiving gypsum board.

H. For fire-rated and acoustically rated construction, comply with requirements of tested assemblies scheduled on the drawings.
I. Continue required components of fire-rated and acoustically rated wall assembly to overhead structure. Apply joint tape and one coat of compound to gypsum board joints concealed from view in completed work.

J. Seal openings and penetrations in fire-rated construction as specified in Firestopping section.

K. Sound barriers: Construct as indicated above ceilings at operable partitions. Tape gypsum board joints. Seal terminations and penetrations with acoustical sealant.

L. Attach gypsum board to resilient channels with screws of length to not contact framing.

M. Allowable tolerances in framed gypsum board construction.
   1. Position: +/- 1/4" maximum variation from design position.
   2. Alignment: 1/8" in 8'-0"; 1/4" maximum in any continuous wall, line or surface.
   3. Surface plane: 1/8" in 12'-0"; 1/16" in 1'-0", maximum variation in true surface plane.
   4. Surface smoothness: No joint or fastener location, roughness or blemish discernible after application of finish when viewed at any angle from a distance of 5'-0" under occupancy lighting conditions, with surface preparation as specified in Painting section.

N. Allowable tolerances in suspended gypsum board furring system ceilings:
   1. Deflection: Suspension system components, hangers and fastening devices supporting lighting fixtures, ceiling grilles and acoustical units shall have maximum deflection of 1/360 of span when tested in accord with ASTM C635-07.
   2. Bow, camber and twist: Not exceeding tolerances established by ASTM C635-07.
   3. Variation from level in finished ceiling: +/- 1/8" in 12'-0".
   4. Variation in plane of adjacent gypsum board panels prior to joint treatment: 1/16".

3.4 SINGLE LAYER APPLICATION

A. Ceilings: Apply gypsum board with long dimension at right angles to framing. Terminate edges of gypsum board running parallel to framing on framing members.

B. Walls:
   1. Apply gypsum board vertically or horizontally at Contractor's option, except as required by gypsum board manufacturer's product data for system designs, including fire-rated and acoustically rated partitions.
   2. Stagger end joints in opposite sides of partitions.
   3. Terminate edges of gypsum board running parallel to framing, furring on framing or furring members.

C. Fastening: Attach gypsum board using fasteners specified at spacings required by manufacturer's product data.

3.5 DOUBLE LAYER APPLICATION

A. Base layer:
   1. Ceilings: Apply base layer with long dimension at right angle to framing. Terminate edges of gypsum board running parallel to framing on framing members.
   2. Walls: Apply base layer vertically. Terminate edges of gypsum board running parallel to framing, furring on framing or furring members. Stagger vertical joints on opposite sides of partitions.
   3. Fastening: Attach gypsum board using fasteners specified, at spacings required by manufacturer's product data.

B. Face layer:
   1. Apply face layer at right angle to base layer with minimum 10" offset in parallel base and face layer joints.
2. Fastening: Attach gypsum board using fasteners specified, at spacings required by manufacturer's product data.

3.6 JOINT TREATMENT

A. Finish Levels shall be in accord with the Recommended Specification: Levels of Gypsum Board Finish as published jointly by the Gypsum Association, AWCI, CISCA and PDCA.

B. Finish Level 1; Joint treatment for non-public, non-service areas to receive no further finish, including storage areas: Apply joint compound to joints and angles in gypsum board and embed joint tape. Surfaces shall be free of excess joint compound; tool marks and ridges are acceptable.

C. Finish Level 2; Joint treatment for areas indicated to receive no further finish, including unfinished service areas, mechanical and electrical rooms, janitors closets: Apply joint compound to joints, angles, fastener heads and accessories. Embed joint tape. Apply one additional coat of compound over tape. Apply one coat of compound to fastener depressions. Surfaces shall be free of excess joint compound; tool marks and ridges are acceptable.

D. Finish Level 3; Joint treatment for areas indicated to receive tile finishes:
   1. Water-resistant, coated glass mat backer board:
      a. Embed glass fiber mesh tape in skim coat of material used to set tiles on joints and corners that are to receive tile.
      b. Caulk or seal penetrations and abutments to dissimilar materials
   2. Finish joints shall be free of tool marks and ridges.

E. Finish Level 4; Joint treatment for areas indicated to receive flat and satin paint finishes:
   1. Apply joint compound to joints, angles, fastener heads and accessories. Embed joint tape. Apply three additional coats of compound over tape, featheredging and sanding each coat.
   2. Apply minimum of three coats of compound to fastener depressions, sanding each coat and bringing to level plane with gypsum board surface.
   3. All joint compound shall be free of tool marks and ridges.

F. Finish Level 5: Not used.

G. Fastener pop: Drive new fastener approximately 1-1/2” from popped fastener and repair to match gypsum board finish.

H. Fill cracks with joint compound and sand smooth and flush.

I. Dust surfaces and leave ready for decoration. Joint and fastener treatment shall be indistinguishable in finished work.
## APPENDIX – SCHEDULE OF SUBMITTALS

<table>
<thead>
<tr>
<th>Submittal Number</th>
<th>Item Number</th>
<th>Description</th>
<th>Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td>09 2900</td>
<td></td>
<td>Gypsum Board Assemblies</td>
<td></td>
</tr>
<tr>
<td></td>
<td>092900-1.3-A-01</td>
<td>Product Data - Studs</td>
<td></td>
</tr>
<tr>
<td></td>
<td>092900-1.3-A-02</td>
<td>Product Data – Floor &amp; Ceiling Runners</td>
<td></td>
</tr>
<tr>
<td></td>
<td>092900-1.3-A-03</td>
<td>Product Data – Gypsum Board</td>
<td></td>
</tr>
<tr>
<td></td>
<td>092900-1.3-A-04</td>
<td>Product Data – Fire Resistant Gypsum Board</td>
<td></td>
</tr>
<tr>
<td></td>
<td>092900-1.3-A-05</td>
<td>Product Data – Water Resistant Gypsum Board</td>
<td></td>
</tr>
<tr>
<td></td>
<td>092900-1.3-A-06</td>
<td>Product Data – Fire Resistant Water Resistant Gypsum Board</td>
<td></td>
</tr>
<tr>
<td></td>
<td>092900-1.3-A-07</td>
<td>Product Data - Fasteners</td>
<td></td>
</tr>
<tr>
<td></td>
<td>092900-1.3-A-08</td>
<td>Product Data – Joint Tape</td>
<td></td>
</tr>
<tr>
<td></td>
<td>092900-1.3-A-09</td>
<td>Product data – Joint Compound</td>
<td></td>
</tr>
<tr>
<td></td>
<td>092900-1.3-A-10</td>
<td>Product Data – Suspended Gypsum Board Furring System</td>
<td></td>
</tr>
<tr>
<td></td>
<td>092900-1.3-A-11</td>
<td>Product Data – Corner Reinforcement</td>
<td></td>
</tr>
<tr>
<td></td>
<td>092900-1.3-A-12</td>
<td>Product Data - Trim</td>
<td></td>
</tr>
<tr>
<td></td>
<td>092900-1.3-A-13</td>
<td>Product Data – Control Joints</td>
<td></td>
</tr>
<tr>
<td></td>
<td>092900-1.3-A-14</td>
<td>Product Data – Resilient Channel</td>
<td></td>
</tr>
<tr>
<td></td>
<td>092900-1.3-A-15</td>
<td>Product Data – Furring Brackets</td>
<td></td>
</tr>
</tbody>
</table>

END OF SECTION
PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Suspended metal ceiling grid system.
   2. Acoustical panels.

B. Related Sections:
   1. Division 01 - Administrative, procedural, and temporary work requirements.

1.2 REFERENCES

A. ASTM International (ASTM):
   5. E1264 - Standard Classification of Acoustical Ceiling Products.


C. Underwriters Laboratories, Inc. (UL) - Fire Resistance Directory.

1.3 SUBMITTALS

A. Shop drawings; include the following:
   1. Layout, including locations of lighting fixtures and grilles.
   2. Insert and hanger spacing and fastening details.
   3. Splicing method for main and cross runners.
   4. Change in level details.
   5. Support requirements for lighting fixtures, grilles and similar items.

B. Product data: Include product descriptions and installation instructions for each material. Indicate load carrying capacity of suspension system hanger spacings and manufacturer's recommended methods for fixture support. Mark manufacturer's brochures to include only those products proposed for use.

C. Samples; submit the following:
   1. 6" by 6" samples of each type and color acoustical material.
   2. Samples of each type and color suspension member and accessory.

D. Certificates: Indicate compliance with specified requirements, including seismic requirements and UL fire-resistive ratings.

1.4 QUALITY ASSURANCE

A. Obtain acoustical panels and supporting suspension system from a single source. Each type of acoustical panel painted grid shall be from a single production run.

B. Installer Qualifications: Minimum 5 years experience in work of this Section.
C. Seismic performance: Comply with code requirements.

D. Job mock-up:
   1. Install complete ceiling of each type specified, in space designated by Architect. Notify Architect when spaces are ready for observation.
   2. Following Architect's acceptance, retain mock-up as a standard of quality for ceiling installation. Accepted mock-up may remain as part of finished work.

1.5 PROJECT/SITE CONDITIONS

A. Sequencing and scheduling: Schedule acoustical material installation to minimize need for removal and replacement of acoustical units to accommodate work of other trades.

B. Environmental Requirements: Install in approximately same conditions of temperature and humidity as will prevail after installation.

1.6 MAINTENANCE MATERIALS

A. Furnish extra materials equal to one percent or one unopened carton, whichever is greater, of each type of acoustical material supplied.

B. Furnish suspension system components in amount sufficient to install extra ceiling units.

PART 2 - PRODUCTS

2.1 METAL SUSPENSION SYSTEMS - GENERAL

A. Metal Suspension-System Standard: Provide manufacturer's standard direct-hung metal suspension systems of types, structural classifications, and finishes indicated that comply with applicable requirements in ASTM C 635/C 635M.
   1. High-Humidity Finish: Comply with ASTM C 635/C 635M requirements for "Coating Classification for Severe Environment Performance" where high-humidity finishes are indicated.

B. Carrying channels: 16 ga. cold-rolled steel, 1-1/2" deep.

C. Attachment Devices: Size for five times the design load indicated in ASTM C 635/C 635M, Table 1, "Direct Hung," unless otherwise indicated. Comply with seismic design requirements.
   1. Hanger clips: Prefabricated metal clamps for fastening to building structure.

D. Wire Hangers, braces, and ties: Provide wires complying with the following requirements:
   2. Stainless-Steel Wire: ASTM A 580/A 580M, Type 304, nonmagnetic.
   3. Size: Select wire diameter so its stress at three times hanger design load (ASTM C 635/C 635M, Table 1, "Direct Hung") will be less than yield stress of wire, but provide not less than 0.106-inch-diameter wire.

E. Seismic Stabilizer Bars: Manufacturer's standard perimeter stabilizers designed to accommodate seismic forces.

F. Seismic Struts: Manufacturer's standard compression struts designed to accommodate seismic forces.

G. Seismic Clips: Manufacturer's standard seismic clips designed and spaced to secure
acoustical panels in place.

H. Hold-Down Clips: Where indicated, provide suspension system manufacturer's standard hold-down clips compatible with ceiling panels specified; spaced 24 inches o.c. on all cross tees.

I. Impact Clips: Where indicated, provide manufacturer's standard impact-clip system designed to absorb impact forces against acoustical panels.

2.2 SUSPENSION SYSTEMS

A. Manufacturer
   1. Acceptable manufacturers; subject to compliance with specified requirements:
      a. Armstrong World Industries, Inc.
      b. CertainTeed Corp.
      c. Chicago Metallic Corp.
      d. USG Interiors, Inc.
   2. Substitutions: Under provisions of Division 01.

B. Basis of design: Armstrong Prelude
   2. Module: 2'-0" by 2'-0".
   3. Main and cross tees:
      a. Tee material: Hot dip galvanized, cold-rolled steel.
      b. Cap material: Hot dip galvanized, cold-rolled steel.
      c. Design: Double web.
      d. Tee size: 15/16" flange face width; 1-1/2" nominal height main tees.
         1) 2'-0" or 4'-0" long cross tees.
         2) Material thicknesses shall be as required to meet specified structural classifications.
   4. Edge molding: Minimum 0.020" thickness galvanized steel, channel or angle shaped with minimum 3/4" flange width, hemmed edge.
   5. Finish on exposed components: Chemically treated for paint adhesion with factory-applied.
      a. Color: Low-gloss white paint.

2.3 ACOUSTICAL PANELS – GENERAL

A. Source Limitations: Obtain each type of acoustical ceiling panel and supporting suspension system from single source from single manufacturer.

2.4 ACOUSTICAL CEILING PANEL ACT-1

A. Manufacturer
   1. Acceptable manufacturers; subject to compliance with specified requirements:
      a. Armstrong World Industries, Inc.
      b. CertainTeed Corp.
      c. USG Interiors, Inc.
   2. Substitutions: Under provisions of Division 01.

B. Basis of design: Armstrong, Ultima 1911
   1. Characteristics:
      a. Size: 2'-0" by 2'-0".
      b. Thickness: 3/4".
      c. Edges: Reveal (angled tegular).
      d. Finish: Factory-applied, washable paint.
2.5 ACCESSORIES

A. Acoustical sealant:
   1. Acoustical sealant for exposed and concealed joints: Manufacturer's standard nonsag, paintable, nonstaining latex sealant complying with ASTM C834-05 and effective in reducing airborne sound transmission through perimeter joints and openings in building construction as demonstrated by testing representative assemblies according to ASTM E90-04.
   2. Acoustical sealant for concealed joints: Manufacturer's standard nondrying, nonhardening, nonskinning, nonstaining, gunnable, synthetic-rubber sealant recommended for sealing interior concealed joints to reduce airborne sound transmission.

B. Sound attenuation blankets: 1-1/2" thickness, minimum 2-1/2 lb. density, paperless, semi-rigid, mineral fiber blanket.

C. T-Grid support clip:
   1. Acceptable products:
      b. Chicago Metallic corp., Perimeter clip 1499.
      c. Erico Products, Inc., Caddy TGE T-Grid support clip.
      d. USG Industries, Inc., Mac 2.
      e. Or equal.
   2. Characteristics: Mechanical clip for attaching acoustical "T" to edge molding without exposed fasteners in grid system.

PART 3 - EXECUTION

3.1 SUSPENSION SYSTEM INSTALLATION

A. Install suspension system in accord with manufacturer's product data, ASTM C636-06, ASTM E580-06 and CISCA recommendations, except for more stringent requirements specified herein.

B. Support suspension system from structure above, not from ductwork, metal deck, equipment or piping.

C. Layout:
   1. Center grid system within areas to avoid panels of unequal widths at opposite walls and panels of less than 1/2 width.
   2. Align grid members straight and perpendicular to walls.
   3. Locate accessories, control joints and expansion joints before installing grid systems.

D. Seismic requirements:
   1. Comply with building code for seismic restraint requirements.
   2. Install suspension systems in accord with ASTM E580-06.
   3. Seismic bracing: In addition to complying with ASTM C636-06 and ASTM E580-06, install suspension systems in accord with CISCA 0-2 and applicable building code requirements.

E. Hangers:
   1. Space hangers for main tees at 4'-0" o. c. maximum. Secure to building structure.
   2. Install additional hangers at ends of each suspension member, within 6" of end of member or wall.
3. Install additional hangers within 6" of each corner of lighting fixtures, grilles and similar items.
4. Splay wires no more than 5" in 2'-6" vertical drop.
5. Where spacing of hangers for main tees exceeds maximum specified spacing due to interference by adjacent construction, indirect-hang tees using carrying channels to maintain maximum hanger spacing.
6. Wrap wire minimum of three times horizontally, turning ends upwards.

F. Direct-hung, exposed grid system, 2'-0" by 2'-0" module:
   1. Space main tees at 4'-0" o. c., maximum, perpendicular to structure.
   2. Locate cross tees at 2'-0" o. c., perpendicular to main tees.
   3. Space cross tees at 2'-0" o. c., perpendicular to previously installed cross tees, to form 2'-0" by 2'-0" grid module. Connect to cross tees through slots in main tees.

G. Level and square suspension system components within specified tolerances prior to beginning ceiling material installation. Install suspension system at Acoustical Cloud parallel with roof decking above.

H. Install cross tees adjacent to lighting fixtures and grilles on each side not supported by main tees. Support no fixtures on main or cross tees when fixture weight results in dead load exceeding deflection capacity of suspension system.

I. Where cut tees intersect other tees or edge moldings without mechanical attachment, attach components using T-Grid support clip. At contractor's option tees may be attached directly to partition with tie wire.

J. Wall moldings:
   1. Install wall molding at intersection of suspended ceiling and vertical surfaces.
   2. Miter corners where wall moldings intersect or install corner caps.
   3. Attach to vertical surfaces with mechanical fasteners.
   4. Where space above ceiling is used as a plenum, apply continuous ribbon of acoustical sealant on vertical web.
   5. Do not use pop rivets.

K. Where grid system exists in an unrestrained condition, brace back to building structure using hanger wire, main tee or carrying channel braces spaced at 4'-0" o. c., maximum.

3.2 ACOUSTICAL CEILING PANEL INSTALLATION

A. Install acoustical units in level plane, in straight line courses, within specified tolerances.

B. Place acoustical materials to bear all around on suspension members.

C. Pattern shall be symmetrical about centerline of area, unless otherwise indicated. Lay out units having directional pattern in same direction.

D. Where ceiling is used as supply or return air plenum, seal joints in acoustical units around pipes, ducts, and ducts and electrical outlets with acoustical sealant.

E. Where cutting of acoustical units is required, cut so that no cut or damaged edges are visible in finished work.

F. Hold-down clips: Install acoustical units surrounding recessed troffer lights with hold-down clips to prevent movement or displacement of units.

G. Lay sound attenuation blankets over ceilings in designated spaces.
H. Allowable tolerances:
   1. Deflection: Suspension system components, hangers and fastening devices supporting lighting fixtures, ceiling grilles and acoustical units shall have maximum deflection of 1/360 of the span when tested in accord with ASTM C635-07.
   2. Bow, camber and twist: Not exceeding tolerances established by C635-04.
   3. Variation from level in finished ceiling: +/- 1/8" in 12'-0".

3.3 CLEANING

A. Clean soiled or discolored unit surfaces after installation.

B. Touch up scratches, abrasions, voids and other defects in painted metal surfaces.

C. Remove and replace damaged and stained acoustical units with new units.

APPENDIX – SCHEDULE OF SUBMITTALS

<table>
<thead>
<tr>
<th>Submittal Number</th>
<th>Item Number</th>
<th>Description</th>
<th>Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td>09 51 00</td>
<td></td>
<td>Acoustical Ceilings</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Submittal</td>
<td></td>
</tr>
<tr>
<td>095100-1.3-A-01</td>
<td>Shop Drawings</td>
<td></td>
<td></td>
</tr>
<tr>
<td>095100-1.3-B-01</td>
<td>Product Data - ACT-1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>095100-1.3-B-03</td>
<td>Product Data - Suspension System</td>
<td></td>
<td></td>
</tr>
<tr>
<td>095100-1.3-B-04</td>
<td>Product Data - Acoustical Sealant</td>
<td></td>
<td></td>
</tr>
<tr>
<td>095100-1.3-B-05</td>
<td>Product Data - Sound Attenuation Blankets</td>
<td></td>
<td></td>
</tr>
<tr>
<td>095100-1.3-B-06</td>
<td>Product Data - T-Grid Support Clip</td>
<td></td>
<td></td>
</tr>
<tr>
<td>095100-1.3-C-01</td>
<td>Samples - ACT-1</td>
<td></td>
<td>Requested by Architect only if not providing basis of design items</td>
</tr>
<tr>
<td>095100-1.3-C-03</td>
<td>Samples - Suspension System</td>
<td></td>
<td>Requested by Architect only if not providing basis of design items</td>
</tr>
<tr>
<td>095100-1.3-D-01</td>
<td>Certificates</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Attic Stock Items</td>
<td>Provide at date of material completion along with inventory of items</td>
</tr>
<tr>
<td>095100-1.6-A-01</td>
<td>Attic Stock - ACT-1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>095100-1.6-A-03</td>
<td>Attic Stock - Suspension System</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

END OF SECTION
SECTION 09 6500
RESILIENT FLOORING AND BASE

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Resilient tile flooring.
   2. Resilient base.
   3. Resilient reducers.

B. Related Sections:
   1. Division 01 - Administrative, procedural, and temporary work requirements.
   2. Section 09 6813 – Tile Carpeting.

1.2 REFERENCES

A. ASTM International (ASTM):
   4. F710 - Standard Practice for Preparing Concrete Floors to Receive Resilient Flooring.

B. Resilient Floor Covering Institute (RFCI) - FloorScore Certification Program.

1.3 SUBMITTALS

A. Shop drawings: Indicate pattern of tile.

B. Product data: Indicate product characteristics and installation requirements, including manufacturer’s recommended adhesives and maintenance instructions. Mark manufacturer’s brochures to include only those products proposed for use.

C. Samples: Submit full size samples for each type color and pattern of flooring and accessory required.

1.4 QUALITY ASSURANCE

A. Installer Qualifications: Minimum 5 years experience in work of this Section.

1.5 DELIVERY, STORAGE AND HANDLING

A. Store resilient flooring and installation materials in dry spaces protected from the weather, with ambient temperatures maintained within range recommended by manufacturer, but not less than 50 deg F or more than 90 deg F. Store floor tiles on flat surfaces.

B. Acclimate resilient flooring products to on-site conditions a minimum of 72 hours prior to start
1.6 PROJECT/SITE CONDITIONS

A. Maintain ambient temperatures within range recommended by manufacturer, but not less than 70 deg F or more than 95 deg F, in spaces to receive floor tile during the following time periods:
   1. 48 hours before installation.
   2. During installation.
   3. 48 hours after installation.

B. After installation and until date of Certification of Material Completion, maintain ambient temperatures within range recommended by manufacturer, but not less than 55 deg F or more than 95 deg F.

C. Close spaces to traffic during floor tile installation.

D. Close spaces to traffic for 48 hours after floor tile installation.

E. Install floor tile after other finishing operations, including painting, have been completed.

F. Protection: Protect finished flooring, base and accessories from staining, marring or other physical damage by work of other trades. Cover or mask surfaces as required.

1.7 WARRANTIES

A. Warrant products against manufacturing defects for 5-years.

B. Warranties commence at Date of Material Completion.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Luxury Vinyl Tile (LVT-1)
   1. Acceptable Manufacturers:
   2. Materials:
      b. Classification: ASTM F 1700 Class III Type B.
      c. Size: 18 x 18 inches
      d. Color: As indicated on drawings.
      e. Total thickness: .120” (3.0 mm).
      f. Wear layer thickness: 30 mil.
      g. Edge Treatment: Square Edge (SE).
      h. Emboss: Standard.
      i. Substitutions: Under provisions of Division 01.

B. Thresholds, Reducers, and Base
   1. Acceptable Manufacturers:
      a. Basis of design: Johnsonite, Inc. (www.johnsonite.com)
      b. BurkeMercer Flooring Products. (www.burkemercer.com)
      c. Flexco. (www.flexcofloors.com)
      d. Roppe Corp. (www.roppe.com)
   2. Thresholds, reducers and base from a single manufacturer for color match.
4. Material: Manufactured from a homogeneous composition of 100% synthetic rubber.
5. Colors: As indicated on drawings.
6. Thresholds:
   a. Molded or extruded rubber saddle.
   b. Lengths as required for opening dimensions, without joints.
   c. Types: As indicated on drawings.
7. Reducers:
   a. Molded or extruded rubber reducer.
   b. Thickness: Same as abutting floor materials.
   c. Types: As indicated on drawings.
8. Base:
   a. Characteristics:
      1) Complies with ASTM F1861, Type TS, Group 1.
      2) Length: 100'-0" rolls, minimum.
      3) Thickness: 1/8".
      4) Height: 4".
      5) Style: Coved.
   b. Corners: Preformed inside and outside corners. Preformed corners shall match base in color, sheen and overall appearance.

C. Carpet edgings and cap strip specified in 09 6813 “Tile Carpeting.”

2.2 INSTALLATION MATERIALS

A. Leveling compound; acceptable products:
   1. Custom Building Products, LevelQuik RS.
   2. Euclid Chemical Co., Floorstone with Latex Liquid.
   3. Mapei, PLANI/PATCH.
   4. Or equal.

B. Adhesives: Water-resistant types and brands of adhesive recommended by flooring material manufacturer’s product data for installation conditions indicated.
   1. VOC Content: Comply with the following limits when calculated according to 40 CFR 59, Subpart D (EPA Method 24):
      a. VCT Adhesives: Not more than 50 g/L.
      b. Cove Base Adhesives: Not more than 50 g/L.

PART 3 - EXECUTION

3.1 PREPARATION

A. Prepare surfaces to receive resilient material in accord with flooring manufacturer=s instructions.

B. Grind high areas and fill depressions with leveling compound where required to produce smooth installation and for proper alignment of resilient flooring with adjacent flooring materials.

C. Perform bond and moisture tests on subfloors in accord with ASTM F2170-02 and resilient flooring manufacturer=s product data, to determine if surfaces are acceptable to receive specified resilient flooring products. Correct conditions detrimental to resilient flooring installation prior to starting installation.

D. Remove dirt, oil, grease or other foreign matter from surfaces to receive floor covering or accessories.
3.2 APPLICATION OF ADHESIVES

A. Mix and apply adhesives in accord with resilient material manufacturer=s product data. Apply with notched trowel or other tools as recommended by adhesive manufacturer.

B. Provide safety precautions during mixing and applications as recommended by adhesive manufacturer.

C. Apply adhesive to only that area which can be covered by resilient material within the recommended working time of the adhesive.
   1. Remove adhesive which dries or films over.
   2. Do not soil walls, bases or adjacent areas with adhesives.
   3. Remove spilled or misplaced materials.

3.3 TILE INSTALLATION

A. Unless otherwise indicated on drawings, lay tile in accord with resilient tile manufacturer=s product data.

B. Lay tile beginning at center of room or space, working toward perimeter.
   1. Adjust starting point as necessary to provide border tile widths equal to or greater than a half width tile.
   2. Joints between tile shall be fitted without gap; butted together.
   3. Cut border tile to fit within 1/32" of abutting surfaces.

C. Fit flooring material into breaks and recesses, against bases, around pipes and penetrations, under saddles or thresholds and around permanent cabinets and equipment.

D. Lay tile with grain or pattern running in same direction as adjacent tiles.

3.4 INSTALLATION OF BASE

A. Workmanship:
   1. Unroll base material and allow to relax for 24 hours, minimum, prior to installation. Cut into lengths resulting in single unjointed lengths for runs less than 100'-0". For longer runs, use only one piece less than 100'-0" in straight runs with no piece being less than 40'-0" in length. Double-cut adjoining lengths.
   2. Install with tight butt joints with no joint widths greater than 1/64".

B. Top-set base:
   1. Apply adhesive and adhere to vertical surfaces.
   2. Press down so that bottom edge follows floor profile.
   3. Form internal corners using premolded corners.
   4. Form external corners using premolded corners.
   5. Scribe base to abutting materials.

3.5 ACCESSORY INSTALLATION

A. Cut materials to lengths and sizes indicated.

B. Resilient thresholds and reducers:
   1. Apply adhesives and bond to substrate.
   2. Center thresholds and reducers in door openings.
   3. Fit edge to door frame jambs without visible gaps or cracks.
   4. Fit edges to abutting floor materials for flush fit.

3.6 CLEANING
A. Upon completion of installation, clean surfaces using a neutral cleaner acceptable to material manufacturer.

B. Just prior to Date of Substantial Completion, buff no-wax floors using buffing compound for no-wax finish and apply minimum two coats of non-slip wax to clean waxable floor surfaces and buff.

APPENDIX – SCHEDULE OF SUBMITTALS

<table>
<thead>
<tr>
<th>Submittal Number</th>
<th>Item Number</th>
<th>Description</th>
<th>Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td>09 6500</td>
<td></td>
<td>Resilient Flooring &amp; Base</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Submittal</td>
<td></td>
</tr>
<tr>
<td>096500-1.3-A-01</td>
<td>Shop Drawings</td>
<td></td>
<td></td>
</tr>
<tr>
<td>096500-1.3-B-01</td>
<td>Product Data – LVT-1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>096500-1.3-B-03</td>
<td>Product Data - Thresholds</td>
<td></td>
<td></td>
</tr>
<tr>
<td>096500-1.3-B-04</td>
<td>Product Data - Reducers</td>
<td></td>
<td></td>
</tr>
<tr>
<td>096500-1.3-B-05</td>
<td>Product Data - Base</td>
<td></td>
<td></td>
</tr>
<tr>
<td>096500-1.3-B-06</td>
<td>Product Data – Leveling Compound</td>
<td></td>
<td></td>
</tr>
<tr>
<td>096500-1.3-B-07</td>
<td>Product Data - Adhesive</td>
<td></td>
<td></td>
</tr>
<tr>
<td>096500-1.3-C-01</td>
<td>Samples – LVT-1</td>
<td>Requested by Architect only if not</td>
<td>providing basis of design items</td>
</tr>
<tr>
<td>096500-1.3-C-03</td>
<td>Samples - Thresholds</td>
<td>Requested by Architect only if not</td>
<td>providing basis of design items</td>
</tr>
<tr>
<td>096500-1.3-C-04</td>
<td>Samples - Reducers</td>
<td>Requested by Architect only if not</td>
<td>providing basis of design items</td>
</tr>
<tr>
<td>096500-1.3-C-06</td>
<td>Samples - Base</td>
<td>Requested by Architect only if not</td>
<td>providing basis of design items</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Project Close-Out Submittals</td>
<td>Provide at date of material completion</td>
</tr>
<tr>
<td>096500-1.7-A-01</td>
<td>Warranty – LVT-1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>096500-1.7-A-03</td>
<td>Warranty - Thresholds</td>
<td></td>
<td></td>
</tr>
<tr>
<td>096500-1.7-A-04</td>
<td>Warranty - Reducers</td>
<td></td>
<td></td>
</tr>
<tr>
<td>096500-1.7-A-05</td>
<td>Warranty - Base</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

END OF SECTION
PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Liquid applied epoxy and aggregate floor finish.
   2. Divider strips.

B. Related Sections:
   1. Division 01: Administrative, procedural, and temporary work requirements.
   2. Section 03 3000 - Cast-In-Place Concrete.

1.2 REFERENCES

A. American Society of Civil Engineers (ASCE) 7 - Minimum Design Loads for Buildings and Other Structures.

B. ASTM International (ASTM):
   10. D4259 - Standard Practice for Abrading Concrete.

1.3 SYSTEM DESCRIPTION

A. This Section includes one resinous flooring system, one with epoxy chemistry
   1. Application Method: Broadcast and stain.

1.4 SUBMITTALS

A. Shop Drawings: Indicate room or space dimensions and location of dividers.

B. Product Data: Manufacturer's product specifications, installation instructions, and general recommendations for each product. Mark manufacturer's brochures to include only those products proposed for use.
C. Samples for Verification:
   1. For each resinous flooring system required, 6 inches (150 mm) square, applied to a rigid backing by Installer for this Project.
   2. 6 inch long divider strip samples.

D. Maintenance Data: Include maintenance procedures, recommended maintenance materials, procedures for stain removal, repairing surface, and suggested schedule for cleaning.

1.5 QUALITY ASSURANCE

A. Installer Qualifications:
   1. Minimum 10 years [documented] experience in work of this Section.
   2. Approved by flooring manufacturer.

B. Fire Hazard Classification: Self-extinguishing, tested to ASTM D635 with maximum 0.25 inch extent of burning.

C. Slip Resistance: Minimum 0.60, tested to ASTM C2047.

D. Mockup:
   1. Size: 10 x 10 feet.
   2. Show: Flooring system, including base and divider strips.
   3. Locate where directed.
   4. Approved mockup may remain as part of the Work.

1.6 DELIVERY, STORAGE AND HANDLING

A. Deliver materials in original packages and containers, with seals unbroken, bearing manufacturer's labels indicating brand name and directions for storage and mixing with other components.

B. All materials used shall be factory pre-weighed and pre-packaged in single, easy to manage batches to eliminate on site mixing errors. No on site weighing or volumetric measurements allowed.

C. Store materials in installation area for 3 days prior to installation to achieve temperature stability. Store materials to prevent deterioration from moisture, heat, cold, direct sunlight, or other detrimental effects. Store material per Product Data sheet.

1.7 PROJECT CONDITIONS

A. Maintain ambient temperature required by manufacturer 3 days prior to, during, and for 24 hours after installation of materials.

B. Environmental Limitations: Comply with resinous flooring manufacturer's written instructions for substrate temperature, ambient temperature, moisture, ventilation, and other conditions affecting resinous flooring application.
   1. Maintain material and substrate temperature between 65 and 85 deg F (18 and 30 deg C) during resinous flooring application and for not less than 24 hours after application.

C. Lighting: Provide permanent lighting or, if permanent lighting is not in place, simulate permanent lighting conditions during resinous flooring application.

D. Close spaces to traffic during resinous flooring application and for not less than 24 hours after application, unless manufacturer recommends a longer period.

E. Concrete substrate shall be properly cured. A vapor barrier must be present for concrete...
subfloors on or below grade. Otherwise, an osmotic pressure resistant grout must be installed prior to the resinous flooring.

1.8 WARRANTIES

A. Manufacturer shall furnish a single, written warranty covering both material and workmanship for a period of one (1) full year.

B. Warranties commence at Date of Material Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Acceptable Products – Resinous Flooring:
   2. Equivalent products by following manufacturers are acceptable:
      a. Dura-Flex, Inc. (www.dur-a-flex.com)
      b. RBC Industries, Inc. (www.rbcepoxy.com)

B. Substitutions: Under provisions of Division 01.

2.2 MATERIALS

A. System Characteristics:
   1. Binder: 100 percent solids epoxy, colored with mineral filler, color and pattern as indicated on the drawings.
   2. Aggregate: Small quartz chips, granular.
   3. Top coat: Epoxy, clear.
   4. Wearing Surface: Medium.
   5. Integral Cove Base: As indicated on the drawings.
   6. Overall System Thickness: 2mm.

B. System Components: Manufacturer’s standard components that are compatible with each other and as follows:
   1. Primer Coat:
      a. Resin: Epoxy.
      b. Formulation Description: (2) two-component, 100 percent solids.
      c. Application Method: squeegee back roll.
      d. Number of Coats: One.
   2. Broadcast: #3 aggregate
      a. Type: non-pigmented.
      c. Number of Coats: One.
   3. Undercoat:
      a. Material Basis: Undercoat
      b. Resin: Epoxy.
      c. Formulation Description: (2) two-component, 100 percent solids.
      d. Type: Clear or pigmented.
      e. Number of Coats: One.
   4. Broadcast: Stainable aggregate
      a. Type: non-pigmented.
      c. Number of Coats: One.
   5. Stain:
      a. Resin: (1) single component waterborne stain.
      b. Formulation Description: waterborne.
c. Application Method: Spray apply.
d. Number of Coats: Multiple to desired color.

6. Sealer:
   a. Resin: Epoxy
   b. Formulation Description: (2) two-component, 100 percent solids, UV stable.
   c. Type: Clear.
   d. Finish: Gloss.
   e. Number of Coats: One.

C. System Physical Properties: Provide resinous flooring system with the following minimum physical property requirements when tested according to test methods indicated:
   1. Tensile Strength: 1,600 psi per ASTM D 638.
   2. Flexural Strength: 4,000 psi per ASTM D 790.
   3. Water Absorption: < 1% per ASTM C 413.
   5. Flammability: Class 1 per ASTM E-648.
   6. Hardness: 85 to 90, Shore D per ASTM D 2240.

2.3 ACCESSORIES

A. Patching, Leveling, and Fill Material: Resinous product of or approved by resinous flooring manufacturer and recommended by manufacturer for application indicated.

B. Joint Sealant: Type recommended or produced by resinous flooring manufacturer for type of service and joint condition indicated. Allowances should be included for Stonf lex MP7 joint fill material.

C. Divider Strips: Height to match flooring thickness, minimum 18 gage white alloy of zinc or brass, with anchoring features.

D. Cove Strips: Type recommended by flooring manufacturer.

E. Subfloor Filler: White, premixed, latex based, type recommended by flooring material manufacturer.

F. Primers, Adhesives, and Sealers: Types recommended by flooring manufacturer.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify that concrete floors have cured a minimum 28 days and do not exhibit negative alkalinity, carbonization, or dusting.

3.2 PREPARATION

A. General: Prepare and clean substrates according to resinous flooring manufacturer’s written instructions for substrate indicated. Provide clean, dry, and neutral Ph substrate for resinous flooring application.

B. Concrete Substrates: Provide sound concrete surfaces free of laitance, glaze, efflorescence, curing compounds, form-release agents, dust, dirt, grease, oil, and other contaminants incompatible with resinous flooring.
   1. Mechanically prepare substrates as follows:
      a. Shot-blast surfaces with an apparatus that abrades the concrete surface, contains the dispensed shot within the apparatus, and recirculates the shot by vacuum pickup or Diamond Grind with dust free system.
b. Comply with ASTM C 811 requirements, unless manufacturer's written instructions are more stringent.

2. Repair damaged and deteriorated concrete according to resinous flooring manufacturer's written recommendations.

3. Verify that concrete substrates meet the following requirements.
   a. Perform in situ probe test, ASTM F 2170. Proceed with application only after substrates do not exceed a maximum potential equilibrium relative humidity of 80 percent.
   b. Perform anhydrous calcium chloride test, ASTM F 1869. Proceed with application only after substrates have maximum moisture-vapor-emission rate of 3 lbs. of water/1000 sq. ft. of slab in 24 hours.
   c. Perform additional moisture tests recommended by manufacturer. Proceed with application only after substrates pass testing.

C. Remove subfloor ridges and bumps. Use patching and fill material to fill low spots, cracks, joints, holes, and depressions in substrates according to manufacturer's written instructions.

D. Treat control joints and other nonmoving substrate cracks to prevent cracks from reflecting through resinous flooring according to manufacturer's written recommendations.

3.3 APPLICATION

A. General: Apply components of resinous flooring system according to manufacturer's written instructions to produce a uniform, monolithic wearing surface of thickness indicated.
   1. Coordinate application of components to provide optimum adhesion of resinous flooring system to substrate, and optimum intercoat adhesion.
   2. Cure resinous flooring components according to manufacturer's written instructions. Prevent contamination during application and curing processes.
   3. At substrate expansion and isolation joints, provide joint in resinous flooring to comply with resinous flooring manufacturer's written recommendations.
      a. Apply joint sealant to comply with manufacturer's written recommendations.

B. Divider Strips: If required, install divider strips at locations indicated. Locate additional joints to align with joints in substrate. Set strips straight and level; attach securely to substrate.

C. Apply primer where required by resinous system, over prepared substrate at manufacturer's recommended spreading rate.

D. Integral Cove Base: Install cove strip at floor to wall junction. Apply cove base mix to wall surfaces before applying flooring. Apply according to manufacturer's written instructions and details including those for taping, mixing, priming, troweling, sanding, of cove base. Round internal and external corners. Cove flooring at vertical surfaces to a height of 4 inches.

E. Broadcast: Immediately broadcast aggregate into the primer using manufacturer's specially designed spray caster. Strict adherence to manufacturer's installation procedures and coverage rates is imperative.

F. Undercoat: Remove any surface irregularities by lightly abrading and vacuuming the floor surface. Mix and apply undercoat with strict adherence to manufacturer's installation procedures and coverage rates.

G. Broadcast: Immediately broadcast stainable aggregate into the undercoat using manufacturer's specially designed spray caster. Strict adherence to manufacturer's installation procedures and coverage rates is imperative.

H. Spray apply single component translucent waterborne stain in number of coats per desired color finish for flooring system and at spreading rates recommended by manufacturer.
I. Apply topcoat(s) in number of coats indicated for flooring system and at spreading rates recommended by manufacturer.

3.4 TERMINATIONS

A. Chase edges to “lock” the flooring system into the concrete substrate along lines of termination.

B. Penetration Treatment: Lap and seal flooring system onto the perimeter of the penetrating item by bridging over compatible elastomer at the interface to compensate for possible movement.

C. Trenches: Continue flooring system into trenches to maintain monolithic protection. Treat cold joints to assure bridging of potential cracks.

D. Treat floor drains by chasing the flooring system to lock in place at point of termination.

3.5 FIELD QUALITY CONTROL

A. Material Sampling: Owner may at any time and any numbers of times during resinous flooring application require material samples for testing for compliance with requirements.
   1. Owner will engage an independent testing agency to take samples of materials being used. Material samples will be taken, identified, sealed, and certified in presence of Contractor.
   2. Testing agency will test samples for compliance with requirements, using applicable referenced testing procedures or, if not referenced, using testing procedures listed in manufacturer's product data.
   3. If test results show applied materials do not comply with specified requirements, pay for testing, remove noncomplying materials, prepare surfaces coated with unacceptable materials, and reapply flooring materials to comply with requirements.

3.6 CLEANING, PROTECTING, AND CURING

A. Cure resinous flooring materials in compliance with manufacturer's directions, taking care to prevent contamination during stages of application and prior to completion of curing process. Close area of application for a minimum of 24 hours.

B. Protect resinous flooring materials from damage and wear during construction operation. Where temporary covering is required for this purpose, comply with manufacturer's recommendations for protective materials and method of application. General Contractor is responsible for protection and cleaning of surfaces after final coats.

C. Cleaning: Remove temporary covering and clean resinous flooring just prior to final inspection. Use cleaning materials and procedures recommended by resinous flooring manufacturer. General Contractor is responsible for cleaning prior to instruction.
# APPENDIX – SCHEDULE OF SUBMITTALS

<table>
<thead>
<tr>
<th>Submittal Number</th>
<th>Item Number</th>
<th>Description</th>
<th>Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td>09 6723</td>
<td></td>
<td>Resinous Flooring</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td><strong>Submittal</strong></td>
<td></td>
</tr>
<tr>
<td>096723-1.4-A-01</td>
<td>Shop Drawings</td>
<td></td>
<td></td>
</tr>
<tr>
<td>096723-1.4-B-01</td>
<td>Product Data – Resinous Flooring</td>
<td></td>
<td></td>
</tr>
<tr>
<td>096723-1.4-B-02</td>
<td>Product Data – A. Patching, Leveling, &amp; Fill Material</td>
<td></td>
<td></td>
</tr>
<tr>
<td>096723-1.4-B-03</td>
<td>Product Data – Joint Sealant</td>
<td></td>
<td></td>
</tr>
<tr>
<td>096723-1.4-B-04</td>
<td>Product Data – Divider Strips</td>
<td></td>
<td></td>
</tr>
<tr>
<td>096723-1.4-B-05</td>
<td>Product Data – Cove Strips</td>
<td></td>
<td></td>
</tr>
<tr>
<td>096723-1.4-B-06</td>
<td>Product Data – Subfloor Filler</td>
<td></td>
<td></td>
</tr>
<tr>
<td>096723-1.4-B-07</td>
<td>Product Data - Primers, Adhesives, &amp; Sealers</td>
<td></td>
<td></td>
</tr>
<tr>
<td>096723-1.4-C-01</td>
<td>Samples for Verification</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td><strong>Project Close-Out Submittals</strong></td>
<td>Provide at date of material completion</td>
</tr>
<tr>
<td>096723-1.4-D-01</td>
<td>Maintenance Data</td>
<td></td>
<td></td>
</tr>
<tr>
<td>096723-1.8-A-01</td>
<td>Warranty</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

END OF SECTION
SECTION 09 6813
TILE CARPETING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Tile carpeting.

B. Related Sections:
   1. Division 01 - Administrative, procedural, and temporary work requirements.
   2. Section 09 6500 – Resilient Flooring & Base.
   3. Section 09 6723 – Resinous Flooring.

1.2 REFERENCES

A. ASTM International (ASTM):
   2. D4258 - Standard Practice for Surface Cleaning Concrete for Coating.
   6. F710 - Standard Practice for Preparing Concrete to Receive Resilient Flooring.

B. Carpet and Rug Institute (CRI):
   2. Indoor Air Quality Testing Program.


1.3 SUBMITTALS

A. Shop Drawings: Indicate carpet tile locations, dye lot limitations, direction of carpet tile in each room or area, and type and location of edgings.

B. Product Data: For each type of carpet tile and accessory. Mark manufacturer's brochures to include only those products proposed for use.

C. Samples:
   1. Carpet tile: 24 x 24 inch samples in each color and pattern.
   2. Edgings and Cap strips:
      a. 4 inch long samples.
      b. Submit with Section 09 6500 - Resilient Flooring & Base.

D. Warranty: Sample warranty form.

E. Certificates of Compliance: Certification from an independent testing laboratory that carpet tiles meet fire hazard classification requirements.
1.4 SYSTEM DESCRIPTION

A. Design criteria; carpet shall meet the following:
   1. Smoke development: Less than 450 when tested in accord with ASTM E662.
   2. Critical radiant flux: Class I, 0.45 watts/cm² when tested in accord with ASTM E648-09.
   3. Flammability of carpet: Pass methanamine pill test when tested in accord with ASTM D2859-06.
   4. Emissions: Provide carpet that complies with testing and product requirements of CRI's "Green Label Plus" program.

1.5 QUALITY ASSURANCE

A. Installer Qualifications: Minimum 10 years experience in work of this Section.

B. Pre-Installation Conference:
   1. Convene at site 2 weeks prior to beginning work of this Section.
   2. Attendance: Contractor, carpet tile installer, and related trades.
   3. Review and discuss: Contract Documents, carpet tile manufacturer's literature, project conditions, scheduling, protection after installation, and other matters affecting application.

1.6 PROJECT CONDITIONS

A. Do not begin installation until painting and finishing work have been completed.

B. Environmental Requirements:
   1. Temperature of spaces and subfloor between 65 and 90 degrees F.
   2. Humidity in spaces to receive carpet tiles between 20 and 65 percent.

1.7 WARRANTIES

A. Furnish manufacturer’s lifetime limited warranty providing coverage against:
   1. Defective materials and workmanship.
   2. Excessive fading.
   3. Loss of static control.
   4. Edge raveling.
   5. Runs.
   7. Loss of face fiber.
   8. Excessive wear.

1.8 MAINTENANCE MATERIALS

A. Furnish extra materials equal to one percent or one unopened carton, whichever is greater, of each type of carpet tile supplied.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Acceptable Manufacturers - Carpet Tiles:
   1. Tandus Centiva (www.tandus-centiva.com)

2.2 MATERIALS
A. Carpet Tiles CPT-1:
1. Pattern: Tandus Centiva #04839 "Assertive Stria."
2. Color: As indicated on drawings.
4. Face yarn type: TDX® Nylon.
5. Dye method: 100% solution dyed.
6. Pattern type: Linear.
7. Face yarn weight: 28 ounces per square yard.
8. Gauge: 5/64.
10. Pile height average: 0.187.
11. Primary Backing: Non-woven synthetic fiber.
12. Size: 24 x 24 inches.

B. Carpet Tiles CPT-2:
1. Pattern: Tandus Centiva #04849 "Maelstrom."
2. Color: As indicated on drawings.
4. Face yarn type: Dynex SD® Nylon.
5. Dye method: 100% solution dyed.
7. Face yarn weight: 18 ounces per square yard.
8. Gauge: 5/64.
10. Pile height average: 0.187.
11. Primary Backing: Non-woven synthetic fiber.
12. Size: 24 x 24 inches.

C. No substitutions permitted.

2.3 ACCESSORIES

A. Adhesive:
1. Waterproof, latex based cement formulated specifically for installing carpet tiles; recommended by carpet tile manufacturer.

B. Edgings:
1. Manufacturer: Same as resilient base.
2. Preformed rubber.
3. Profile required to suit conditions.
4. Color to match resilient base.

C. Cap Strip:
1. Manufacturer: Same as resilient base.
2. Preformed rubber.
3. Profile required to suit conditions.
4. Color to match resilient base.

D. Leveling Compound: Premixed, latex based.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify that concrete floors have cured a minimum 28 days and do not exhibit negative
alkalinity, carbonization, or dusting.

3.2 PREPARATION
A. Clean substrate; remove loose and foreign matter that could impede adhesion or performance of flooring.
B. Fill cracks, voids, and depressions with leveling compound.
C. Grind ridges and high spots smooth.
D. Test Substrate:
   1. Moisture vapor: Test to ASTM F1869; do not install carpet tiles until moisture emission level is 3 pounds per 1000 square feet or less.
   2. Humidity: Test to ASTM F2170; do not install carpet tiles until relative humidity is 75 percent or less.
   3. Alkalinity: Test to ASTM F710; do not install carpet tiles unless pH is 9 or less.

3.3 INSTALLATION OF CARPET TILES
A. Install in accordance with CRI 104.
B. Install carpet tile and adhesive in accordance with manufacturers’ instructions.
C. Blend carpet tiles from different cartons to ensure minimal variation in color match.
D. Lay out each room or area to minimize tiles less than one half size.
E. Cut tile clean. Fit tiles tight to intersection with vertical surfaces without gaps.
F. Lay carpet tile to monolithic pattern, with tile direction parallel to next unit, set parallel to building lines.
G. Locate change of color or pattern between rooms under door centerline.
H. Fully adhere carpet tiles to substrate.

3.4 INSTALLATION OF EDGINGS
A. Install strips where carpet tiles abut dissimilar flooring materials; secure to subfloor.
B. Center strips under doors where carpet tiles terminate at door openings.
C. Install in longest practical lengths; butt ends tight.
D. Scribe to abutting surfaces.

3.5 CLEANING
A. Clean spots as recommended by carpet tile manufacturer.
B. Cut off loose threads flush with top surface.
C. Clean with commercial vacuum cleaner.
## APPENDIX – SCHEDULE OF SUBMITTALS

<table>
<thead>
<tr>
<th>Submittal Number</th>
<th>Item Number</th>
<th>Description</th>
<th>Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td>09 6813</td>
<td></td>
<td><strong>Tile Carpeting</strong></td>
<td></td>
</tr>
<tr>
<td></td>
<td>096813-1.3-A-01</td>
<td>Shop Drawings</td>
<td></td>
</tr>
<tr>
<td></td>
<td>096813-1.3-B-01</td>
<td>Product Data – CPT-1</td>
<td></td>
</tr>
<tr>
<td></td>
<td>096813-1.3-B-02</td>
<td>Product Data – CPT-2</td>
<td></td>
</tr>
<tr>
<td></td>
<td>096813-1.3-B-03</td>
<td>Product Data - Adhesive</td>
<td></td>
</tr>
<tr>
<td></td>
<td>096813-1.3-B-04</td>
<td>Product Data – Edgings &amp; Cap Strips</td>
<td></td>
</tr>
<tr>
<td></td>
<td>096813-1.3-B-05</td>
<td>Product Data – Leveling Compound</td>
<td></td>
</tr>
<tr>
<td></td>
<td>096813-1.3-C-01</td>
<td>Samples – CPT-1</td>
<td></td>
</tr>
<tr>
<td></td>
<td>096813-1.3-C-02</td>
<td>Samples – CPT-2</td>
<td></td>
</tr>
<tr>
<td></td>
<td>096813-1.3-C-03</td>
<td>Samples - Edgings &amp; Cap Strips</td>
<td>Submit with Section 09 6500 – Resilient Flooring &amp; Base</td>
</tr>
<tr>
<td></td>
<td>096813-1.3-D-01</td>
<td>Sample Warranty Form</td>
<td></td>
</tr>
<tr>
<td></td>
<td>096813-1.3-E-01</td>
<td>Certificate of Compliance</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Project Close-Out Submittals</td>
<td>Provide at date of material completion along with inventory of items</td>
<td></td>
</tr>
<tr>
<td></td>
<td>096813-1.7-A-01</td>
<td>Warranty</td>
<td></td>
</tr>
<tr>
<td></td>
<td>096813-1.8-A-01</td>
<td>Attic Stock – CPT-1</td>
<td></td>
</tr>
<tr>
<td></td>
<td>096813-1.8-A-02</td>
<td>Attic Stock – CPT-2</td>
<td></td>
</tr>
</tbody>
</table>

END OF SECTION
PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   2. Field application of paints.
      a. Ferrous metals.
      b. Galvanized metals.
      a. Concrete masonry units.
      b. Ferrous metals.
      c. Galvanized metals.
      d. Gypsum board.
      e. Gypsum board ceilings.

B. Related Sections:
   1. Division 01 - Administrative, procedural, and temporary work requirements.
   2. Section 04 2000 – Unit Masonry
   3. Section 08 1113 - Hollow Metal Frames
   4. Section 09 2900 – Gypsum Board Assemblies
   5. Division 26 – Electrical
   6. Division 27 - Communications

1.2 REFERENCES


   2. SSPC-SP 2 - Hand Tool Cleaning; 1982 (Ed. 2000).
   3. SSPC-SP 7 - Brush-Off Blast Cleaning; 2000.

D. Environmental Protection Agency (EPA), volatile organic compounds (VOC) standards as required by local codes and regulations.

1.3 DEFINITIONS

A. Conform to ASTM D 16 for interpretation of terms used in this section.

B. Gloss Ranges: Tested in accordance with ASTM D 523.
   1. Flat refers to a lusterless or matte finish with a gloss range between 0 and 5 when measured at an 60-degree meter.
   2. Eggshell refers to low-sheen finish with a gloss range between 5 and 20 when measured at a 60-degree meter.
   3. Satin refers to low-to-medium-sheen finish with gloss range between 15 and 35 when measured at a 60-degree meter.
   4. Semi-gloss refers to medium-sheen finish with a gloss range between 30 and 65 when
measured at a 60-degree meter.
5. Gloss refers to high-sheen finish with a gloss range more than 65 when measured at a 60-degree meter.

1.4 SUBMITTALS

A. Product data:
1. Submit complete list of products proposed for use at least 30 days prior to commencement of painting work.
2. Indicate manufacturer, brand name, quality, type, and sheen for each type of paint and for each surface to be finished. Indicate VOC rating and compliance with applicable regulations.
3. Indicate manufacturer’s instructions regarding mixing, surface preparation and application. Include application rates, film thickness and required primers.
4. Intent of Contractor to use products specified does not relieve him from responsibility of submitting product list.
5. Mark manufacturer’s brochures to include only those products proposed for use.

B. Paint Schedule: Indicate types and locations of each surface, paint materials, and number of coats to be applied.

C. Card stock brush-outs: Prepare two sets of color coat brush-outs for each paint and stain color and sheen scheduled, applying actual finish color coat to standard sample card stock, minimum 80 sq. in. size.

D. Substrate brush-outs:
1. In addition to color coat brush-outs, submit one actual brush-out sample application for each paint type, color and sheen as applicable to the following substrates.
   a. Concrete unit masonry: One face of a concrete block of type and texture used on the project.
   b. Gypsum board and concrete: Apply over gypsum board, 1'-0" by 1'-0" size, edges taped and sanded.
   c. Metals: Apply over hardboard, 1'-0" by 1'-0" size.
   d. Painted wood: Wood stock typical of type, color and cut used on the project, minimum 6" wide by 1'-0" long.

1.5 QUALITY ASSURANCE

A. Applicator Qualifications: Minimum 5 years experience in work of this Section.


C. Mockup:
1. Construct mockup panels for interior wall finishes, 4 feet wide x 8 feet high.
2. Show: Each color and texture.
3. Locate where directed by Architect.
4. Approved mockup may remain as part of the Work.

1.6 DELIVERY, STORAGE AND HANDLING

A. Container Labels: Include manufacturer’s name, type of paint, brand name, lot number, brand code, coverage rates, surface preparation, drying time, cleanup requirements, color designation, and instructions for mixing and reducing.
B. Storage and handling:
   1. Store at ambient temperature from 45 to 90 degrees F in ventilated area, or as required
      by manufacturer's instructions.
   2. Maintain neat, clean conditions in storage area; remove rags and waste materials at
      end of each day's work.
   3. Close containers at end of day's work. Leave no materials open.

1.7 ENVIRONMENTAL REQUIREMENTS

A. Do not apply materials when surface and ambient temperatures are outside the temperature
   ranges required by the paint product manufacturer.

B. Do not apply exterior coatings during rain or snow; on surfaces coated with frost; or when
   relative humidity is outside the humidity ranges required by the paint product manufacturer.

C. Do not apply exterior coatings in windy and dusty conditions.

D. Do not apply exterior coatings in direct sunlight or on surfaces which will soon be warmed by
   the sun.

E. Application Temperatures for Waterborne Paints: Minimum 45 degrees F for interiors;
   minimum 50 degrees F for exterior; maximum 90 degrees F (32 degrees C), unless required
   otherwise by manufacturer's instructions. Maintain interior temperatures until paint is
   completely dry and cured.

F. Application Temperatures for Solvent Thinned Paints: Minimum 50 degrees F (10 degrees
   C) for interiors and exterior; maximum 95 degrees F (35 degrees C), unless required
   otherwise by manufacturer's instructions. Maintain interior temperatures until paint is
   completely dry and cured.

G. Provide lighting level of 80 ft candles measured mid-height at substrate surface.

H. Ventilation: Ventilate affected areas during paint application. Exhaust solvent vapors
   outdoors, away from air intakes and people.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Acceptable Manufacturers:

B. All paints and coatings to be from single manufacturer.

C. Substitutions: Under provisions of Division 01.

2.2 ACCESSORY MATERIALS

A. Accessory Materials: Linseed oil, shellac, turpentine, paint thinners and other materials not
   specifically indicated but required to achieve the finishes specified; commercial quality.

B. Patching Material: Latex filler.

C. Fastener Head Cover Material: Latex filler.
2.3 MIXES
   A. Deliver paints pre-mixed and pre-tinted.
   B. Uniformly mix to thoroughly disperse pigments.
   C. Do not thin in excess of manufacturer's recommendations.
   D. Re-mix paint during application; ensure complete dispersion of settled pigment and uniformity of color and gloss.

2.4 COLORS:
   A. Paint and stain colors shall be as indicated on Finishes Legend with final approval based on brush-out submittal.

PART 3 - EXECUTION

3.1 EXAMINATION
   A. Verify that surfaces are ready to receive work as instructed by the product manufacturer.
   B. Examine surfaces scheduled to be finished prior to commencement of work. Report any condition that may potentially affect proper application.

3.2 PREPARATION
   A. General:
      1. Start of the surface preparation or paint materials application will be construed as applicator's acceptance of the surfaces as satisfactory for application of materials.
      2. Surface Appurtenances: Remove electrical plates, hardware, light fixture trim, escutcheons, and fittings prior to preparing surfaces or finishing.
      3. Surfaces: Correct defects and clean surfaces of substances which affect work of this section. Remove or repair existing coatings that exhibit surface defects.
      4. Marks: Seal with sealer compatible with primer and finish coats marks which may bleed through surface finishes.
      5. Impermeable Surfaces: Remove mildew by scrubbing with solution of tetra-sodium phosphate and bleach. Rinse with clean water and allow surface to dry.
      6. Reduce the gloss of glossy surfaces to be painted.
      7. Fill nail holes, cracks, chips, spalls, and similar damaged areas to match adjacent undamaged areas.
   
   B. Concrete Unit Masonry Surfaces to be Painted:
      1. Remove dirt, efflorescence, laitance, and other foreign matter.
      2. Remove oil and grease with a solution of trisodium phosphate; rinse well and allow to dry.
      3. Remove stains caused by weathering of corroding metals with a solution of sodium metasilicate after thoroughly wetting with water. Allow to dry.
      4. Surface clean concrete masonry to receive paint, in accordance with ASTM D 4261. Rinse with water and allow to dry.
      5. Allow surfaces to dry at least 30 days before applying paint materials.
   
   C. Uncoated Ferrous Metal Surfaces to be Painted: Remove grease, mill scale, weld splatter, dirt, and rust. Where heavy coatings of scale are evident, remove by hand wire brushing in accordance with SSPC SP-2, or sandblasting in accordance with SSPC SP-7; clean by washing with solvent or detergent in accordance with SSPC SP-1. Apply a treatment of phosphoric acid solution, ensuring weld joints, bolts, and nuts are similarly cleaned. Prime
D. Shop-Primed Ferrous Metal Surfaces to be Finish Painted:
   1. Sand and scrape to remove loose primer and rust. Feather edges to make touch-up patches inconspicuous.
   2. In flat, exposed surfaces to receive semi-gloss or gloss finish, fill dents, holes and similar voids and depressions in flat exposed surfaces with metal filler compound. Finish flush with adjacent surfaces.
   3. Clean surfaces with solvent in accordance with SSPC SP-1.
   4. Prime bare steel surfaces immediately upon detection.

E. Galvanized Surfaces to be Painted: Remove surface contamination and oils and wash with solvent in accordance with SSPC SP-1 or detergent. Wipe with metal cleaner, rinse, and wipe dry.

F. Gypsum Board Surfaces to be Painted:
   1. Fill minor defects with filler compound. Spot prime defects after repair.
   2. Remove loose dust and dirt by brushing with a soft brush, rubbing with a cloth, or vacuum cleaning. A damp cloth may be used when water based paint materials are to be applied. Allow to dry.

G. Wood Surfaces to be Painted:
   1. Wipe off dust and grit prior to priming.
   2. Scrape and clean small, dry seasoned knots, then apply a thin coat of commercial knot sealer, before application of the priming coat.
   3. Scrape off pitch on large, open, unseasoned knots and all other beads or streaks of pitch and sap. If the pitch is still soft, remove with mineral spirits or turpentine, and thinly coat the resinous area with knot sealer.
   5. Sand between coats.
   6. Set finishing nails, fill holes, and prime surface imperfections. After priming, fill holes and imperfections in finish surfaces with putty or plastic wood filler, colored to match the finish coat if natural finish is required, allowed to dry, and sand smooth.

H. Wood Surfaces to be Stained:
   1. Scrape and clean small, dry seasoned knots, then apply a thin coat of commercial knot sealer, before application of staining coat.
   2. Scrape off pitch on large, open, unseasoned knots and all other beads or streaks of pitch and sap. If the pitch is still soft, remove with mineral spirits or turpentine, and thinly coat the resinous area with knot sealer.
   3. Fill nail holes, cracks and defects with wood filler matching finish color.
   4. Sand surfaces smooth except where rough sawn surfaces are indicated. Final step shall remove scuffs, handling marks and effects of moisture exposure. Dust to remove debris.
      a. Sand plane surfaces using sanding block.
      b. Sand surfaces within normal visual range, including surfaces within 10’-0” of floor level, using not less than 80 grit abrasive exterior or 100 grit abrasive interior, except increase to 120 to 180 grit abrasive for transparent finished interior surfaces.
      c. Install prefinished or presurfaced items following finishing or sanding of adjacent surfaces. Replace prefinished items damaged by finishing of adjacent work.

3.3 APPLICATION

A. Unless otherwise specified or recommended by the paint manufacturer, paint may be applied by brush, roller, or spray. Rollers for applying paints and enamels shall be of a type designed for the coating to be applied and the surface to be coated.
1. Brushes: Use brushes best suited for type of material applied. Use brush of appropriate size for surface or item being painted.
2. Rollers: Use rollers of carpet, velvet-back, or high-pile sheep's wool as recommended by manufacturer for material and texture required.
3. Spray Equipment: Use airless spray equipment with orifice size as recommended by manufacturer for material and texture required.

B. Thinning:
1. When thinning is required to suit surface, temperature, weather conditions, or application methods, paints may be thinned in accordance with the manufacturer's directions.
2. The use of thinner shall not relieve the Contractor from obtaining complete hiding, full film thickness, or required gloss. Thinning shall not cause the paint to exceed limits on volatile organic compounds.

C. Do not mix paint materials of different manufacturers.

D. Where adjacent sealant is to be painted, do not apply finish coats until sealant is applied.

E. Do not apply finishes to surfaces that are not dry. Allow applied coats to dry before next coat is applied.

F. Apply each coat to uniform appearance. Apply each coat of paint in a tint slightly darker than preceding coat unless otherwise approved. Difference in tint shall be visible at a distance of 3 feet (0.9 m) from the surface.

G. Vacuum clean surfaces of loose particles. Use tack cloth to remove dust and particles just prior to applying next coat.

H. Minimum Coating Thickness:
1. Apply paint materials no thinner than manufacturer's recommended spreading rate to achieve dry film thickness as recommended by manufacturer. Provide total dry film thickness of the entire system as recommended by manufacturer.
2. Insure that all edges, corners, crevices, welds, and rivets receive a film thickness equal to that of adjacent painted surfaces.
3. Apply each coat of paint so dry film shall be of uniform thickness and free from runs, drops, ridges, waves, pinholes or other voids, laps, brush marks, and variations in color, texture, and finish. Hiding shall be complete.

I. Back prime and seal ends of interior panel backer boards specified to be finished.

3.4 PROTECTION AND CLEANING

A. Collect waste material which may constitute a fire hazard, place in closed metal containers, and remove daily from site.

3.5 SURFACES TO BE FINISHED

A. Do Not Paint or Finish the Following Items:
1. Items fully factory-finished unless specifically noted.
2. UL, FMG, or other code required labels; fire rating labels; and equipment name, identification, performance rating, serial number and capacity labels.
3. Stainless steel items.
4. Door hardware including hinges.

B. Paint the surfaces described in Schedules at the end of this Section and as follows:
3.6 EXTERIOR PRIMERS

A. Exterior Alkyd Ferrous Metal Primer:
   3. PPG Paints; 6-208 Speedhide Alkyd Rust Inhibitive Primer.

B. Exterior Acrylic Galvanized Metal Primer:
   1. Basis of design: The Sherwin-Williams Co.; B66W310 Pro Industrial Pro-Cryl Universal Primer
   2. B50ZW3 Galvite H.S. Metal Primer.
   4. PPG Paints; 6-209 Speedhide Galvanized Metal Primer.

3.7 EXTERIOR FINISH COATS

A. Semi-Gloss Acrylic Finish Coats for Ferrous and Galvanized Metals:

3.8 INTERIOR PRIMERS, SEALERS AND FILLERS

A. Interior Block Filler for Concrete Masonry Units:
   2. Benjamin Moore & Co.; 571 Ultra Spec Hi-Build Masonry Block Filler.
   3. PPG Paints; 6-7 Speedhide Acrylic Latex Masonry Block Filler.

B. Interior Acrylic Primer for Gypsum Board:
   3. PPG Paints; 6-4900XI Speedhide Zero Interior Zero VOC Latex Primer Sealer.

C. Interior Alkyd Ferrous Metal Primer:
   3. PPG Paints; 6-212 Speedhide Alkyd Rust Inhibiting Metal Primer.

D. Interior Acrylic Primer for Galvanized Metal:
   3. PPG Paints; 90-712 Pitt-Tech Waterborne Acrylic DTM Primer.

E. Interior Alkyd Primer for Wood:
   2. Benjamin Moore & Co.; 024 Fresh Start All-Purposed Interior/Exterior Alkyd Primer.
   3. PPG Paints; 17-941NF Seal Grip Int/Ext Alkyd Universal Primer Sealer.

F. Interior Stain for Wood:
   2. Benjamin Moore & Co.; 1AS.12XX Lenmar QuickStain Alkyd Wiping Stain.
   3. PPG Paints; Deft DFT 400 Interior Wood Stain.
3.9 INTERIOR FINISH COATS

A. Flat Acrylic Finish Coats for Gypsum Board:
   3. PPG Paints; 6-4110XI Speedhide Zero Interior Zero VOC Latex Flat Wall Paint.

B. Eggshell Acrylic Finish Coats for Concrete Masonry Units and Gypsum Board:

C. Semi-Gloss Acrylic Finish Coats for Wood:

D. Semi-Gloss Acrylic Finish Coats for Ferrous Metal:

E. Semi-Gloss Acrylic Finish Coat for Galvanized Metal:

F. Polyurethane Varnish for Wood:
   3. PPG Paints; Deft DFT 159 Water Based Interior Acrylic Polyurethane, Satin.

3.10 PAINT SCHEDULE - EXTERIOR

A. Ferrous Metals:
   1. First Coat: Alkyd ferrous metal primer.
   2. Two Top Coats: Semi-gloss acrylic.

B. Galvanized Metal:
   1. First Coat: Acrylic galvanized metal primer.
   2. Two Top Coats: Semi-gloss acrylic.

3.11 PAINT SCHEDULE - INTERIOR

A. Concrete Masonry Units:
   1. First Coat: Acrylic Latex Block Filler.
   2. Two Top Coats: Eggshell acrylic latex.

B. Ferrous Metals:
   1. First Coat: Alkyd ferrous metal primer.
2. Two Top Coats: Semi-gloss acrylic.

C. Galvanized Metal:
1. First Coat: Acrylic primer.
2. Two Top Coats: Semi-gloss acrylic.

D. Gypsum Board:
1. First Coat: Acrylic latex primer.
2. Two Top Coats: Semi-gloss acrylic.

E. Gypsum Board Ceilings:
1. First Coat: Acrylic latex primer.
2. Two Top Coats: Eggshell acrylic latex enamel.

F. Wood Trusses & Wood Deck:
1. First Coat: Interior stain for wood.
2. Two Top Coats: Polyurethane varnish for wood.

G. Wood Electrical and Communication Backer Boards: As specified in Division 26.
### APPENDIX – SCHEDULE OF SUBMITTALS

<table>
<thead>
<tr>
<th>Submittal Number</th>
<th>Item Number</th>
<th>Description</th>
<th>Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td>09 9000</td>
<td>Paints &amp; Coatings</td>
<td>Submittal</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>099000-1.4-A-01</td>
<td>Product Data – Ext. Alkyd Ferrous Mtl. Primer</td>
</tr>
<tr>
<td></td>
<td></td>
<td>099000-1.4-A-02</td>
<td>Product Data – Ext. Acrylic Galvanized Mtl. Primer</td>
</tr>
<tr>
<td></td>
<td></td>
<td>099000-1.4-A-04</td>
<td>Product Data – Int. Block Filler for CMU</td>
</tr>
<tr>
<td></td>
<td></td>
<td>099000-1.4-A-06</td>
<td>Product Data – Int. Alkyd Ferrous Mtl. Primer</td>
</tr>
<tr>
<td></td>
<td></td>
<td>099000-1.4-A-08</td>
<td>Product Data – Int. Alkyd Primer for Wood</td>
</tr>
<tr>
<td></td>
<td></td>
<td>099000-1.4-A-09</td>
<td>Product Data – Int. Flat Acrylic for Gyp. Bd.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>099000-1.4-A-11</td>
<td>Product Data – Int. Semi-Gloss Acrylic for Wood</td>
</tr>
<tr>
<td></td>
<td></td>
<td>099000-1.4-B-01</td>
<td>Paint Schedule</td>
</tr>
<tr>
<td></td>
<td></td>
<td>099000-1.4-C-01</td>
<td>Card Stock Brush-outs</td>
</tr>
<tr>
<td></td>
<td></td>
<td>099000-1.4-D-01</td>
<td>Substrate Brush-outs</td>
</tr>
</tbody>
</table>

END OF SECTION
SECTION 09 9600
HIGH-PERFORMANCE COATINGS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Resinous coating for vertical surfaces.

B. Related Sections:
   1. Division 01: Administrative, procedural, and temporary work requirements.
   2. Section 09 2900 - Gypsum Board Assemblies.
   3. Section 09 6723 - Resinous Flooring.

1.2 REFERENCES

A. Applicable standards; standards of the following, as referenced herein:
   1. ASTM International (ASTM).

1.3 SYSTEM DESCRIPTION

A. Resinous wall is a high performance, high solids, high gloss, pigmented 10 to 12 mil/250 to 300 microns wall system comprised of two coats of Stronglaze E4, with the appropriate primer.

1.4 SUBMITTALS

A. Product Data: Manufacturer's product specifications, installation instructions, and general recommendations for each product. Mark manufacturer's brochures to include only those products proposed for use.
   1. For initial selection of colors and finishes, submit manufacturer's color charts showing full range of colors and finishes available.

B. Samples: Submit, for verification purposes, 4-inch square samples of each type of resinous wall system required, applied to a rigid backing, in color and finish indicated.

C. Warranty: Sample warranty form.

1.5 QUALITY ASSURANCE

A. Installer Qualifications:
   1. Minimum 10 years experience in work of this Section.
   2. Licensed or certified by coating system manufacturer.

B. Single Source Responsibility: Obtain primary resinous wall materials including primers, resins, hardening agents, finish or sealing coats from a single manufacturer with not less than ten years of successful experience in manufacturing and installing principal materials described in this section. Contractor shall have completed at least five projects of similar size and complexity. Provide secondary materials only of type and from source recommended by manufacturer of primary materials.

C. Pre-Installation Conference:
   1. Convene at site 2 weeks prior to beginning work of this Section.
3. Review and discuss: Contract Documents, coating system manufacturer's literature, project conditions, scheduling, and other matters affecting application.
4. Tour representative areas of substrates; discuss substrate construction, related work, work conditions, and materials compatibility.

D. Mockup:
   1. Provide mockup of coatings applied to gypsum wall board.
   2. Size: 5'-0" by 5'-0" minimum.
   3. Show: Surface preparation, primer, intermediate, and top coats.
   4. Locate where directed.
   5. Approved mockup may remain as part of the Work.

1.6 DELIVERY, STORAGE AND HANDLING
A. Material shall be delivered to job site and checked by wall contractor for completeness and shipping damage prior to job start.
B. All materials used shall be factory pre-weighed and pre-packaged in single, easy to manage batches to eliminate on site mixing errors. No on site weighing or volumetric measurements allowed.
C. Material shall be stored in a dry, enclosed area protected from exposure to moisture. Temperature of storage area shall be maintained at or above 65oF/18oC in a dry area. Avoid excessive heat. Do not freeze. The shelf life is 3 years in the original unopened container.

1.7 PROJECT CONDITIONS
A. Drywall, including joint work, must be completely finished at least 3 days prior to wall system installation.
B. Utilities, including electric, water, heat (air temperature between 60 and 85F/16 and 30C) and finished lighting to be supplied by General Contractor.
C. Job area to be free of other trades during, and for a period of 24 hours, after wall installation.
D. Protection of finished walls from damage by subsequent trades shall be the responsibility of the General Contractor.

1.8 WARRANTIES
A. Manufacturer shall furnish a single, written warranty covering both material and workmanship for a period of one (1) full year.
B. Warranties commence at Date of Material Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Acceptable Products – Resinous Coating System:

C. Equivalent products by following manufacturers are acceptable:
   b. Key Resin Co. (www.keyresin.com)
D. Substitutions: Under provisions of Division 01.

2.2 MATERIALS

A. Resinous Coating System is a high performance, high solids, high gloss pigmented 10 to 12 mil/250 to 300 microns wall system comprised of two coats of Stonglaze E4, with the appropriate primer.
   1. Physical Properties: Provide wall system in which physical properties of topping when tested in accordance with standards or procedures referenced below, are as follows:
      a. Pot Life: 20 to 25 minutes @ 70°F/21°C.
      b. Minimum Dry Film Thickness: 10 mil/250 microns.
      c. Cure Rate: 12 hours for tack free surface at 77°F/25°C; 24 hours minimum for normal operations.
      d. Temperature Limitations: 140°F/60°C for continuous exposure; 200°F/93°C intermittent exposure.
      e. Fire Resistance of Dry Film: Class A (ASTM E84) Flame spread 10; Smoke developed 20.
      f. V.O.C: 39g/l (ASTM D-2369).

2.3 ACCESSORIES

A. Thinners and Cleaners: Types recommended by manufacturer.

B. Joint Sealant Materials: Type produced by manufacturer of resinous wall system for type of service and joint condition indicated.

PART 3 - EXECUTION

3.1 PREPARATION

A. Gypsum Wall Board Substrate:
   1. Wall board surface must be finished to a level 3 drywall finish with an appropriate spackle compound.
   2. Moisture resistant gypsum board and cement fiber board require water resistant drywall compound.

3.2 APPLICATION

A. General: Apply each component of resinous wall system in compliance with manufacturer's directions to produce a uniform monolithic wearing surface of thickness indicated, uninterrupted except at divider strips, sawn joints or other types of joints (if any), indicated or required.

B. Primer: Mix and apply material according to manufacturer's recommended procedures.

C. Epoxy Base Coat: Mix epoxy base coat components with fiberglass additive. Apply base coat to primed wall surface.

D. Top Coat: Mix material according to manufacturer's recommended procedures.

3.3 FIELD QUALITY CONTROL

A. The right is reserved to invoke the following material testing procedure at any time, and any number of times during period of wall application.

B. The Owner will engage service of an independent testing laboratory to sample materials being used on the job site. Samples of material will be taken, identified and sealed, and...
certified in presence of Contractor.

C. Testing laboratory will perform tests for any of characteristics specified, using applicable testing procedures referenced herein, or if none referenced, in manufacturer’s product data.
   1. If test results show materials being used do not comply with specified requirements, Contractor may be directed by Owner to stop work; remove non-complying materials; pay for testing; reapply wall materials to properly prepared surfaces which had previously been coated with unacceptable materials.

3.4 CURING, PROTECTION AND CLEANING

A. Cure resinous wall materials in compliance with manufacturer’s directions, taking care to prevent contamination during stages of application and prior to completion of curing process. Close area of application for a minimum of 24 hours.

B. Protect resinous wall materials from damage and wear during construction operation. Where temporary covering is required for this purpose, comply with manufacturer’s recommendations for protective materials and method of application. General Contractor is responsible for protection and cleaning of surfaces after final coats.

C. Cleaning: Remove temporary covering and clean resinous wall system just prior to final inspection. Use cleaning materials and procedures recommended by resinous wall system manufacturer. General contractor is responsible for cleaning prior to inspection.

3.5 ADJUSTING

A. Touch up minor damage or refinish as required.

3.6 CLEANING

A. Remove coatings from adjacent surfaces.

APPENDIX – SCHEDULE OF SUBMITTALS

<table>
<thead>
<tr>
<th>Submittal Number</th>
<th>Item Number</th>
<th>Description</th>
<th>Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td>09 9600</td>
<td></td>
<td>High-Performance Coatings</td>
<td>Submittal</td>
</tr>
<tr>
<td></td>
<td>099600-1.4-A-01</td>
<td>Product Data</td>
<td></td>
</tr>
<tr>
<td></td>
<td>099600-1.4-B-01</td>
<td>Sample for Verification</td>
<td></td>
</tr>
<tr>
<td></td>
<td>099600-1.4-C-01</td>
<td>Sample Warranty Form</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Project Close-Out Documentation</td>
<td>Provide at date of material completion</td>
</tr>
<tr>
<td></td>
<td>099600-1.8-A-01</td>
<td>Warranty</td>
<td></td>
</tr>
</tbody>
</table>

END OF SECTION
SECTION 10 2813
TOILET ACCESSORIES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Toilet accessories.
   2. Hand dryers.
   3. Framed mirrors.

B. Related Sections:
   1. Division 01 - Administrative, procedural, and temporary work requirements.
   2. Section 06 1000 – Rough Carpentry
   3. Section 09 2900 – Gypsum Board Assemblies
   4. Section 09 6723 – Resinous Flooring
   5. Section 09 9600 – High-Performance Coatings

1.2 REFERENCES

A. ASTM International (ASTM):
   3. A666 - Standard Specification for Annealed or Cold-Worked Austenitic Stainless Steel Sheet, Strip, Plate, and Flat Bar.

B. Underwriters Laboratories, Inc. (www.ul.com) - Listed Products.

1.3 SUBMITTALS

A. Product data: Include catalog cuts and data sheets indicating size, material and finish, complete parts list and installation procedures for each accessory. Where manufacturer's standard products vary with design criteria, indicate compliance with design criteria. Mark manufacturer's brochures to include only those products proposed for use.

B. Samples: Submit one actual sample of each accessory for approval if requested by Architect. Upon approval, samples will be returned for incorporation into project.

1.4 QUALITY ASSURANCE

A. Applicable standards; comply with the following as referenced herein: Americans with Disabilities Act (ADA).

B. Hand Dryers: Tested and certified by UL; bear UL Listing Mark.

1.5 PROJECT/SITE CONDITIONS

A. Protection: Maintain manufacturer's protective covering on accessories until final cleanup of
installation.

B. Coordinate this work with work of other trades into which accessories are to be installed.

1.6 WARRANTIES

A. Mirrors: Warrant mirrors for five years against silver spoilage.

B. Hand Dryers: Warrant hand dryers for five years.

C. Warranties commence at Date of Material Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS - ACCESSORIES

A. Acceptable manufacturers; subject to compliance with specified design criteria:
   1. Basis of design; Bobrick Washroom Equipment, Inc. (www.bobrick.com)
   3. Bradley Corp. (www.bradleycorp.com)
   4. Gamco USA (www.gamcousa.com)

B. Substitutions: Under provisions of Division 01.

2.2 DESIGN CRITERIA - ACCESSORIES

A. All accessories shall be products of a single manufacturer.

B. Weld joints of fabricated components and grind smooth.

C. Provide hangers, adapters, anchor plates, and accessories required for installation.

D. Keying: Keyed accessories shall be keyed alike, unless otherwise specified.

E. Operation: Control and operating mechanisms shall be operable with one hand, without tight grasping, pinching, or twisting of wrist, and with a maximum force of 5 lbf.

F. Cabinet construction:
   1. Material: Entire cabinet shall be constructed of 18-8 S, Type 304 stainless steel, minimum 22 ga., except that doors of flush face cabinets shall be minimum 18 ga.
   2. Finish: Satin finish, vertical grain stainless steel; matching in color and graining within the same cabinet.
   3. Unit construction: Seamless or welded; welds ground smooth prior to finishing on exposed surfaces. Cabinets shall have full, continuous backs and sides. Flush face units shall be seamless construction.
   4. Hinges: Doors shall be hung on continuous stainless steel piano hinges.
   5. Stops: Doors shall have spring or cable stops located inside cabinet to limit opening to 120 degrees maximum.
   6. Bumpers: Doors shall have rubber bumpers to cushion door closing.
   7. Exposed edges: Hemmed, returned or flanged; sharp edges not allowable.
   8. Paper towel dispensers: Adaptable to dispense C-fold, multi-fold or single-fold towels without use of additional towel trays.
   9. Feminine napkin/tampon vendors: Changeable coin mechanisms and coin slot identification; lockable coin box keyed differently from other accessories.

G. Combination towel/waste units: Capable of mounting such that towel dispenser is located at 3'-4" above finish floor, while allowing at least 4" base below unit.
H. Soap dispensers:
   1. Valves: All-purpose dispensing type; piston and exposed components of Type 302/304 stainless steel or chrome-plated brass.
   2. Lavatory-mounted dispensers: Capable of being filled from top, without removal of container.

I. Grab bars: Fabricate grab bars of tubing, free of visible joints, return to wall with end attachment flanges.

J. Mirrors:
   1. Frame: One piece, roll formed stainless steel channel, 1/2 x 1/2 inch, with corners mitered and welded.
   2. Mirror: Apply one coat of silver, one coat of electroplated copper, and one coat of organic mirror backing compound to back surface of glass.
   4. Isolate glass from frame and backing with resilient, waterproof padding.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Check opening scheduled to receive recessed or semi-recessed accessories for correct dimensions, depth, plumbness of blocking or frames, and preparation that would affect installation of accessories.

3.2 INSTALLATION

A. Install accessories level, plumb and in indicated location. Installation methods shall be as indicated in product data for substrates encountered. Securely attach to blocking or framing members.

B. Mounting heights: As indicated on drawings and meeting ADA accessibility requirements applicable at time of construction.

C. Grab bars:
   1. Secure grab bars to wood by direct attachment to studs or to blocking installed between studs.
   2. Secure grab bars to metal stud partition by direct attachment to steel studs, using 1/4" diameter toggle bolts, or using minimum 12 ga. by 3" wide steel anchor plates, continuous length required for attachment of grab bar flanges.
      a. Attach anchor plates to studs on grab bar side of wall, using self-tapping sheet metal screws.
      b. Where grab bar flanges mount on separate walls, anchor plate shall be of length to span between studs at individual flange locations.
      c. Attach grab bars to anchor plates using stainless steel machine screws.
   3. Attach grab bars to masonry walls using concealed mounting plate, minimum 1/4" diameter through-bolt and minimum 10 ga. steel backup plate.
   4. Attach grab bars to concrete walls using 1/4" diameter stainless steel machine screws and metal expansion shields.
   5. Attach grab bars to toilet partitions using wing tapped steel spacers and stainless steel machine screws. Where grab bar is attached to one side of partition only, spacer shall have minimum 16 ga. satin finish stainless steel backup plate.

D. Conceal evidence of drilling, cutting and fitting to adjacent finishes.
E. Install wiring between power supply and hand dryers.

3.3 ADJUSTING AND CLEANING

A. Adjust operating parts of accessories for proper operation.

B. Clean and polish exposed surfaces prior to Date of Substantial Completion.

C. Deliver accessory schedule, keys and parts manual as part of project closeout documents.

APPENDIX – SCHEDULE OF SUBMITTALS

<table>
<thead>
<tr>
<th>Submittal Number</th>
<th>Item Number</th>
<th>Description</th>
<th>Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td>10 2813</td>
<td></td>
<td>Toilet Accessories</td>
<td>Submittal</td>
</tr>
<tr>
<td>102813-1.3-A-01</td>
<td></td>
<td>Product Data – Toilet Tissue Dispenser TA-1</td>
<td></td>
</tr>
<tr>
<td>102813-1.3-A-02</td>
<td></td>
<td>Product Data – Napkin Disposal TA-2</td>
<td></td>
</tr>
<tr>
<td>102813-1.3-A-03</td>
<td></td>
<td>Product Data – Seat Cover Dispenser TA-3</td>
<td></td>
</tr>
<tr>
<td>102813-1.3-A-04</td>
<td></td>
<td>Product Data – Combination Towel &amp; Waste Unit TA-4</td>
<td></td>
</tr>
<tr>
<td>102813-1.3-A-05</td>
<td></td>
<td>Product Data – Soap Dispenser TA-6</td>
<td></td>
</tr>
<tr>
<td>102813-1.3-A-06</td>
<td></td>
<td>Product Data – Baby Changing Station TA-7</td>
<td></td>
</tr>
<tr>
<td>102813-1.3-A-07</td>
<td></td>
<td>Product Data – Mirror TA-8</td>
<td></td>
</tr>
<tr>
<td>102813-1.3-A-08</td>
<td></td>
<td>Product Data – Mirror TA-9</td>
<td></td>
</tr>
<tr>
<td>102813-1.3-A-09</td>
<td></td>
<td>Product Data – 36” Grab Bar TA-10</td>
<td></td>
</tr>
<tr>
<td>102813-1.3-A-10</td>
<td></td>
<td>Product Data – 42” Grab Bar TA-11</td>
<td></td>
</tr>
<tr>
<td>102813-1.3-A-11</td>
<td></td>
<td>Product Data – 18” Grab Bar TA-12</td>
<td></td>
</tr>
<tr>
<td>102813-1.3-B-01</td>
<td></td>
<td>Samples - Toilet Tissue Dispenser TA-1</td>
<td>Provide only if requested by Architect</td>
</tr>
<tr>
<td>102813-1.3-B-02</td>
<td></td>
<td>Samples - Napkin Disposal TA-2</td>
<td>Provide only if requested by Architect</td>
</tr>
<tr>
<td>102813-1.3-B-03</td>
<td></td>
<td>Samples - Seat Cover Dispenser TA-3</td>
<td>Provide only if requested by Architect</td>
</tr>
<tr>
<td>102813-1.3-B-04</td>
<td></td>
<td>Samples - Combination Towel &amp; Waste Unit TA-4</td>
<td>Provide only if requested by Architect</td>
</tr>
<tr>
<td>102813-1.3-B-05</td>
<td>Samples - Soap Dispenser TA-6</td>
<td>Provide only if requested by Architect</td>
<td></td>
</tr>
<tr>
<td>-----------------</td>
<td>--------------------------------</td>
<td>-------------------------------------</td>
<td></td>
</tr>
<tr>
<td>102813-1.3-B-06</td>
<td>Samples - Baby Changing Station TA-7</td>
<td>Provide only if requested by Architect</td>
<td></td>
</tr>
<tr>
<td>102813-1.3-B-07</td>
<td>Samples - Mirror TA-8</td>
<td>Provide only if requested by Architect</td>
<td></td>
</tr>
<tr>
<td>102813-1.3-B-08</td>
<td>Samples - Mirror TA-9</td>
<td>Provide only if requested by Architect</td>
<td></td>
</tr>
<tr>
<td>102813-1.3-B-09</td>
<td>Samples -36” Grab Bar TA-10</td>
<td>Provide only if requested by Architect</td>
<td></td>
</tr>
<tr>
<td>102813-1.3-B-10</td>
<td>Samples -42” Grab Bar TA-11</td>
<td>Provide only if requested by Architect</td>
<td></td>
</tr>
<tr>
<td>102813-1.3-B-11</td>
<td>Samples -18” Grab Bar TA-12</td>
<td>Provide only if requested by Architect</td>
<td></td>
</tr>
</tbody>
</table>

**Project Close-Out Submittals**

Provide at date of material completion along with inventory of items.

<table>
<thead>
<tr>
<th>102813-1.6-A-01</th>
<th>Warranty - Mirrors</th>
</tr>
</thead>
<tbody>
<tr>
<td>102813-1.6-B-01</td>
<td>Warranty – Hand Dryers</td>
</tr>
</tbody>
</table>

END OF SECTION
SECTION 10 4413
FIRE EXTINGUISHERS & CABINETS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Portable fire extinguishers.
   2. Cabinets and wall brackets.

B. Related Sections:
   1. Division 01 - Administrative, procedural, and temporary work requirements.
   2. Section 06 1000 – Rough Carpentry
   3. Section 09 2900 – Gypsum Board Assemblies

1.2 REFERENCES


B. National Fire Protection Association (NFPA) 10 - Portable Fire Extinguishers.

C. Underwriters Laboratories (UL):
   1. 154 - Carbon Dioxide Fire Extinguishers.
   2. 299 - Dry Chemical Fire Extinguishers.
   3. 626 - 2-1/2 Gallon Stored Pressure, Water Type Fire Extinguishers.
   5. 2129 - Halocarbon Clean Agent Fire Extinguishers.

1.3 SUBMITTALS

A. Shop Drawings: Indicate cabinet and bracket locations and mounting heights.

B. Product Data: Include data on extinguishers and cabinets, brackets, operational features, materials, finishes, and anchorage. Mark manufacturer’s brochures to include only those products proposed for use.

C. Maintenance Data: Include test, refill, or recharge schedules and re-certification requirements.

1.4 QUALITY ASSURANCE

A. Provide fire extinguishers complying with UL 711 and applicable code.

B. Cabinets in Fire Rated Partitions: Tested in accordance with ASTM E814 with fire resistance rating equivalent to adjacent construction.

C. Conform to applicable accessibility code for locating extinguishers.

1.5 PROJECT CONDITIONS

A. Do not install extinguishers when ambient temperature may cause freezing of extinguisher ingredients.

PART 2 - PRODUCTS
2.1 MANUFACTURERS

A. Acceptable Manufacturers:
   2. Ansul Incorporated. (www.ansul.com)
   3. JL Industries. (www.jlindustries.com)
   4. Potter Roemer. (www.potterroemer.com)

B. Substitutions: Under provisions of Division 01.

2.2 COMPONENTS

A. Extinguishers:
   1. Basis of design: Larsen’s model DC-10.
   2. Multi-purpose dry chemical type, UL 299, cast steel tank, Class 4A:60B:C, 10 pound nominal capacity.
   3. Free from CFCs, HCFCs, and Halons.

B. Cabinets:
   1. Basis of design: Larsen’s Occult series model AL-O-2409.
   2. Fire-rated partitions: Provide rated cabinets; Larsen’s “Flame Shield” option.
   3. Formed steel sheet, 18 gage minimum.
   4. Configuration: Recessed, sized to accommodate extinguishers.
   5. Trim: Returned to wall surface.
   6. Door:
      a. Vertical Duo Door style, equipped with pull handle and latch.
      b. Hinge doors for 180 degree opening with continuous piano hinge.
      c. Glazing: Clear tempered glass.
      d. Graphics: None.

C. Brackets:

2.3 ACCESSORIES

A. Mounting Hardware: Type best suited to application.

2.4 FINISHES

A. Cabinet:
   1. Exterior and door: Dark bronze anodized.
   2. Interior: Baked enamel, white.

B. Extinguishers: Baked enamel, red color.

C. Brackets: Manufacturer’s standard finish.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install cabinets in accordance with manufacturer’s instructions.

B. Set plumb, level, and rigid.

C. Place an extinguisher in each cabinet.
## APPENDIX – SCHEDULE OF SUBMITTALS

<table>
<thead>
<tr>
<th>Submittal Number</th>
<th>Item Number</th>
<th>Description</th>
<th>Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td>10 4413</td>
<td></td>
<td>Fire Extinguishers &amp; Cabinets</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Submittal</td>
<td></td>
</tr>
<tr>
<td>104413-1.3-A-01</td>
<td></td>
<td>Shop Drawings</td>
<td></td>
</tr>
<tr>
<td>104413-1.3-B-01</td>
<td></td>
<td>Product Data - Extinguishers</td>
<td></td>
</tr>
<tr>
<td>104413-1.3-B-02</td>
<td></td>
<td>Product Data – F.E. Cabinets</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td><strong>Project Close-Out Submittals</strong></td>
<td>Provide at date of material completion</td>
</tr>
<tr>
<td>104413-1.3-C-01</td>
<td></td>
<td>Maintenance Data</td>
<td></td>
</tr>
</tbody>
</table>

END OF SECTION
SECTION 11 3100
RESIDENTIAL APPLIANCES

PART 1 - GENERAL

1.1 SUMMARY
A. Section Includes:
   1. Dishwashers.
   2. Refrigerators.

B. Related Sections:
   1. Division 01 - Administrative, procedural, and temporary work requirements.
   2. Division 22 – Plumbing connections.
   3. Division 26 – Electrical connections.

1.2 REFERENCES
A. U.S. Department of Energy (DOE):
   1. Energy Star Program Requirements for Certified Products.

1.3 SUBMITTALS
A. Product data: Include product descriptions and installation instructions for each material. Mark manufacturer's brochures to include only those products proposed for use.

1.4 QUALITY ASSURANCE
A. Appliances: Energy Star rated.

1.5 DELIVERY, STORAGE AND HANDLING
A. Deliver appliances with manufacturer's protective coverings in place; do not remove until just prior to installation.

B. Coordinate installation of appliances required to be built into other work. Secure templates or lay out to rough dimensions provided by equipment manufacturer.

C. Protect prefinished surfaces from damage or staining. Following installation, provide protective covering for equipment until Date of Substantial Completion.

1.6 WARRANTIES
A. Furnish manufacturer’s standard one year appliance warranties as part of Contract closeout documents. Warranties shall begin on Date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS
A. Acceptable manufacturers:
   2. GE Appliances. (www.geappliances.com)
   3. Frigidaire. (www.frigidaire.com)

2.2 APPLIANCES
A. Countertop microwave oven:
   1. Basis of design: Whirlpool model #WMC30516AS
   2. Size: 1.6 cubic ft.
   3. Cooking power: 1200 watts
   4. Finish: stainless steel
   5. Features:
      a. 10 power levels
      b. One touch cooking
      c. Timer
      d. Recessed glass turntable
      e. Sensor cooking cycles
      f. Clock
   6. Control selections:
      a. Add 30 Seconds
      b. Beverage
      c. Control Lock
      d. Cook Time
      e. Defrost
      f. Dinner Plate
      g. End of Cycle Signal
      h. Favorites, Fresh Vegetable
      i. Frozen Entrée
      j. Frozen Vegetable
      k. Popcorn, Potato
      l. Reheat
      m. Scale
      n. Soup

B. Refrigerator:
   1. Basis of design: Whirlpool model #WRT108FZDM
   2. Size: 18 cubic ft.
      a. Freezer capacity: 5.09 cubic ft.
      b. Refrigerator capacity: 13.06 cubic ft.
   3. Finish: stainless steel
   4. Features:
      a. EZ Connect icemaker
      b. Freezer temperature controls
      c. Electronic temperature controls

2.3 ACCESSORIES

A. Refrigerator icemaker connector water-line: ¼"C x ¼"C x 72" stainless steel braiding over braided PVC with brass inserts. It shall be 6'-0" in length and allow for easy movement of the refrigerator. Stainless steel supply line shall have ¼ compression connections on each end for easy connections between refrigerator and water supply shut-off valve. NSF 61 – National Science Foundation approved for safer drinking water. No tube cutting, bending or soldering.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install appliances in accordance with manufacturer’s instructions and approved Shop Drawings.

B. Set plumb, level, and aligned.
C. Perform final electrical connections under requirements of Division 26, Electrical; mechanical and plumbing connections under Division 22, Plumbing.

D. Just prior to Date of Substantial Completion, clean exterior and interior of appliances using cleaners as recommended by manufacturer’s product data.

APPENDIX – SCHEDULE OF SUBMITTALS

<table>
<thead>
<tr>
<th>Submittal Number</th>
<th>Item Number</th>
<th>Description</th>
<th>Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td>11 3100</td>
<td>113100-1.3-A-01</td>
<td>Product Data – Microwave Oven</td>
<td></td>
</tr>
<tr>
<td></td>
<td>113100-1.3-A-02</td>
<td>Product Data – Refrigerator</td>
<td></td>
</tr>
<tr>
<td></td>
<td>113100-1.6-A-01</td>
<td>Warranty – Microwave Oven</td>
<td>Provide at date of material completion</td>
</tr>
<tr>
<td></td>
<td>113100-1.6-A-02</td>
<td>Warranty - Refrigerator</td>
<td></td>
</tr>
</tbody>
</table>

END OF SECTION
SECTION 22 0010
PLUMBING GENERAL

PART 1: GENERAL

1.01 DESCRIPTION:
A. These plumbing general provisions specified herein apply to all Sections of Division 22.
B. Refer to the General and Supplementary Conditions and Division 01 for special requirements and conditions which apply to all Sections of Division 22.
C. This Division and the following Sections include responsibilities and obligations in support of the performance verification specified in Section 22 00 90, Plumbing Performance Verification, and commissioning specified in Section
D. This Section covers the plumbing general requirements.

1.02 QUALITY ASSURANCE:
A. Conform to the following:
B. Codes, standards and regulations specified herein refer to the edition date. Revisions and addenda to these codes, standards and regulations shall be part of these specifications. Provisions of referenced codes, standards, and regulations do not create duty or responsibility by the Architect Engineer or the Owner, unless otherwise specified herein.
C. Codes, standards and regulations referred to are minimum standards. Where the requirements of these specifications or drawings exceed those of the codes, standards and regulations, the drawings or specifications shall govern.
D. Plumbing Design Coordination:
   1. Reasonable efforts have been made to coordinate plumbing with the following associated trades.
   2. Electrical:
      a. The power ratings of motors, and other plumbing electrical equipment with the electrical characteristics serving them, as specified herein and indicated on the Drawings, have been established as minimums which will allow that equipment to satisfactorily function while producing the required capacities. These power ratings include a safety factor deemed appropriate to accommodate common differences between design parameters and field construction practices. Under no circumstances shall equipment with power ratings less than those indicated on the Drawings or specified herein be provided.
      b. Differences among manufacturers of plumbing equipment make it impossible to produce a single electrical design which will satisfy the varying electrical requirements of those manufacturers. Consequently, the Contractor shall coordinate the electrical requirements of the plumbing equipment actually furnished on this Project, and provide the electrical systems required by that equipment. This coordination effort shall be completed prior to the installation of either the plumbing equipment or the electrical systems serving that equipment. Electrical system revisions required to coordinate with the plumbing equipment actually furnished shall be provided at no additional cost to the Owner.

1.03 UTILITY CONNECTIONS AND SERVICE:
A. Water:
   1. Arrange for connection to the water main, extension of service and installation of a meter of not less than " size, with a pressure drop of not more than psi at gpm flow. Pay charges in connection therewith.
B. Sewers:
   1. Arrange for the sewer connections and pay charges in connection therewith.
2. The installation shall comply with the requirements of the Water Pollution Control Division of the City.

1.04 SUBMITTALS:

A. Within 5 15 days after notice to proceed, submit a schedule indicating the proposed submission date of each submittal specified herein. Schedule shall anticipate the submittal review time, the possible need for resubmittals, and the time required for fabrication, shipping and integration into the construction sequence. Architect Engineer will advise of any conflicts in reviewing submittals that the proposed schedule presents.

B. Submittals shall be prepared in a line-by-line format corresponding to these Specifications and shall indicate compliance with each requirement specified herein and indicated on the Drawings.
   1. In addition to any other transmittals or cover sheets used, fill out and attach to each individual submittal a copy of the Cover Sheet for Submittals to Newcomb & Boyd included at the end of this Section.
   2. Indicate manufacturer's installation instructions.
   3. Indicate deviations, if any, including any from the manufacturer's installation instructions.
   4. Reproductions or electronic versions of design drawings shall not be used in the preparation of shop drawings.
   5. Resubmittals that are required to address review comments shall include a cover transmittal with a written explanation of how each review comment has been addressed.
   6. Submittals not specifically required, or not complying with the format requirements, will be returned unreviewed.
   7. Shop drawings and submittals shall be provided in portable document format (PDF). PDF files containing multiple drawings or components shall include an index of the file contents and electronic bookmarks.

C. Shop drawings shall include the following:
   1. Trade shop drawings (i.e., plumbing piping system drawings, swimming pool equipment room drawings, and electrical main feeder raceway drawings) shall be submitted within 30 days after award of contract.
   2. Approved trade shop drawings shall be utilized as the basis for the coordination drawings. Coordination drawings shall be submitted within 30 days after approval of trade shop drawings.
   3. Coordination drawings shall utilize either manual or electronic means of analyzing the work of each trade in spatial relationship with other trades. Locations of conflicts between trades, and the proposed resolution for each conflict, shall be noted on the coordination drawings submitted.
   4. No work shall be fabricated and/or installed prior to receipt by the Contractor of approved trade shop drawings and approved coordination drawings without specific written authorization from the Architect. Engineer. No change orders will be approved or design assistance provided for remedial field coordination activities for work fabricated and/or installed prior to receipt by the Contractor of approved trade shop drawings and approved coordination drawings.

D. General submittals shall include the following:
   1. Performance Verification Supervisor qualifications.
   2. Coordination drawings, with dimensions and elevations, of plumbing work including equipment, piping with fittings, valves, accessories and sleeves where applicable, coordinated with the work of other trades, including HVAC, fire suppression, electrical, structural, and architectural, minimum 1/4" = 1'-0" scale.

E. Plumbing submittals shall include the following:
   1. Backflow preventers.
   2. Domestic water piping and fittings.
   3. Drains and cleanouts.
   4. Plumbing fixtures and trim.
   5. Sanitary and rainwater piping and fittings.
6. Water heaters, and thermal expansion tanks.

1.05 EQUIPMENT AND INSTALLATION REQUIREMENTS:
A. Equipment and materials shall, unless otherwise specified herein, be new and shall be of the customary standard and quality furnished by the designated manufacturer for that catalogue number.
B. Materials and equipment shall be UL listed, and shall bear the UL listing mark on products for which standards have been established and for which listing is regularly furnished by UL.

PART 2: PRODUCTS

2.01 HANGERS AND SUPPORTS:
A. General:
1. Make hanger assemblies and channel strut systems complete with hanger rods, nuts, bolts, screw attachments, and upper supports attached to the structure as applicable to Project requirements.
2. Select hanger assemblies for single piping, using the weight of piping, insulation, and valves being supported.
3. Select channel strut systems for gang piping, using the combined weight of the piping, insulation, and valves being supported.
4. Select supports for equipment with an additional live load of 300 lb for workers and supplies.
B. Pipe Hangers:
1. Steel piping and insulated water piping 0.5" to 3": adjustable band hanger, steel with galvanized finish and threaded swivel knurl nut.
2. Copper tubing 0.5" to 3", non-insulated: adjustable band hanger, steel with copper finish and threaded swivel knurl nut.
3. Cast iron piping and ductile iron piping: AWWA adjustable clevis hanger, steel with galvanized finish.
   a. Manufacturer: Anvil 590, B-Line B3102, or PHD 420.
C. Equipment Supports:
1. Channel strut systems for equipment supports: minimum 14 gauge galvanized steel strut with factory-punched attachment holes for hanger rods, with stainless steel nuts, and washers.
D. Hanger Rods:
1. One-piece steel type, threaded as required.
2. Sizes for single hangers:

<table>
<thead>
<tr>
<th>Pipe Size</th>
<th>Rod Diameter</th>
</tr>
</thead>
<tbody>
<tr>
<td>2&quot; and smaller</td>
<td>0.375&quot;</td>
</tr>
<tr>
<td>2.5&quot; and 3&quot;</td>
<td>0.5&quot;</td>
</tr>
<tr>
<td>4&quot; and 5&quot;</td>
<td>0.625&quot;</td>
</tr>
<tr>
<td>6&quot; and 8&quot;</td>
<td>0.75&quot;</td>
</tr>
<tr>
<td>10&quot; and 12&quot;</td>
<td>0.875&quot;</td>
</tr>
<tr>
<td>14&quot; to 18&quot;</td>
<td>1.0&quot;</td>
</tr>
</tbody>
</table>

2.02 VALVE TAGS:
A. Minimum 19 gauge polished brass, 1.5" minimum size. Tags shall be round. Stamped numbers and letters shall be not less than 0.75" high, and filled with black paint.

2.03 IDENTIFICATION MATERIALS:
A. Pipe identification shall be 5 mil thick self-adhering laminated vinyl label, meeting ASME A13.1-2015. Lengths may vary due to wording. Widths and legends shall be as follows:
## 2.04 Penetration Seals:

A. Firestops:
   1. Firestops shall consist of an asbestos-free fill material, forming/backing/damming materials, and accessories needed to complete a UL classified through-penetration firestopping system. Fill material shall not slump or sag and shall be the required thickness in the fully cured state.
   2. Firestops shall be designed to seal through-penetrations against flame, heat, smoke and water in compliance with ASTM E84-2016, ASTM E119-2016a, ASTM E814-2013a, and UL 723-2008.
   3. Firestops shall be specifically designed and rated for the individual application, including movement, materials, moisture, penetrating item material, and fire and smoke ratings of the penetrated construction.

## 2.05 Concrete:

A. Normal weight concrete (145 pcf) using Type I Portland Cement, 1" maximum size coarse aggregate to provide a minimum 28 day compressive strength of 3000 psi.

## 2.06 Grout:

A. Nonshrink type, conforming to ASTM C1107/C1107M-2014a when tested at fluid consistency. Grout shall exhibit zero bleeding at every age when mixed to fluid consistency. Minimum 28 day compressive strength, when mixed to fluid consistency, shall be 7000 psi.

B. Manufacturer: Cormix, or Master Builders.

## 2.07 Access Panels - Building:

A. Access panels shall be flush type with concealed hinges. Frame shall be 16 gauge steel or extruded aluminum, and panel shall be 14 gauge steel. Provide flush screwdriver operated cam latches. key operated cylinder locks. Panels shall be finished for painting.

B. Minimum size of panels shall be 12" x 12" for handholes, 18" x 18" elsewhere.

C. Fire rated access panels shall be UL listed, and shall have 16 gauge steel frames, 20 gauge hollow steel door with fire-resistive insulation, finished for painting, automatic closure springs, and key operated cylinder locks.

D. Panels in nonaccessible acoustical tile ceilings shall be designed to accept tiles.

E. Manufacturer: Bar-Co, Cesco, J.L. Industries, Karp, Larsen's, Milcor, or Nystrom.

## 2.08 Escutcheons:

A. Split hinged type, constructed of chromium-plated steel or cast brass, sized to fit over insulation and to cover sleeve.

## 2.09 Underground Warning Tape:

A. Tape shall be acid- and alkali-resistant polyethylene film tape, 6" wide with minimum thickness of 0.004", specifically designed for marking and locating of underground utilities.

### Utility | Color
--- | ---
Diesel fuel | Yellow

Bidding Documents - October 31st 2018

22 0010 - 4 PLUMBING GENERAL
Domestic cold water Blue
Domestic hot water Yellow
Domestic hot water circulating Yellow
Fuel oil Yellow
Gasoline Yellow
Natural gas Yellow
Propane Yellow
Rainwater Green
Reuse water Yellow
Soil Green
Waste Green
Utility located underground, but not listed above Blue

B. Manufacturer: Brady, Boddingtons, Carlton Industries, Seton, or Thor Enterprises.

PART 3: EXECUTION

3.01 PROTECTION OF EQUIPMENT AND MATERIALS DURING CONSTRUCTION:

A. Equipment and Materials-Storage:
   1. Provide protective covers, skids, plugs or caps to protect equipment and materials from damage or deterioration during construction.
   2. Store equipment and material under cover, and off the ground or floors exposed to rain.
   3. For outdoor storage, protective covers of 10 mil thick black sheet plastic shall be fitted over equipment and materials. Covers shall be reinforced to withstand wind and precipitation. Set equipment and material on skids or platforms of height to avoid damage or deterioration from spattering and ground water.
   4. Plastic piping shall not be stored in direct sunlight or at temperatures higher than 95°F: Install the protective covering with 12” clearance over the piping top and sides, and provide for air circulation. Store the piping on skids that will protect from heat sagging or bending.

B. Equipment and Materials-Construction:
   1. Plug ends of pipes when work is stopped to prevent debris from entering the pipes.
   2. Provide dust and debris protection for equipment, motors, and bearings operated during construction up to date of the Architect's final certificate. substantial completion.
   3. Provide protective covers on floor drains and floor sinks during construction to prevent debris from entering the waste piping system. Do not use any covering that will deface the drain grate's finish.

3.02 EQUIPMENT INSTALLATION REQUIREMENTS:

A. Equipment shall be installed and connected as specified herein or indicated on the Drawings in accordance with the manufacturers’ instructions and recommendations for this Project. Furnish and install auxiliary piping, water seals, valves, and electrical connections recommended by the manufacturer for operation.

B. Provide roughing, traps, tail pieces, fittings, waterstops, and connecting piping as required, and make final water supply and drain connections to food service and vending equipment. Slope indirect drains and spillout over a floor sink, trim piping and on a 45° angle.

C. Refer to manufacturer’s or equipment supplier’s shop drawings for exact type, number, location, dimensions and size of connections to equipment, and provide rough-ins and connections accordingly, including, but not limited to:

D. Final connections to laundry equipment shall be made by the laundry vendor.

E. For equipment that does not have water cross connection within, provide check valves in the cold and hot water supplies.

F. In unfinished areas designated for future build-out, install piping, conduit and equipment tight against the structure to maximize future ceiling height.
G. Field-installed equipment controls or sensor wiring shall be installed in conduit. Low voltage control and sensor wiring shall be installed in conduits separate from line voltage control wiring and power wiring.

H. Where water pipe sizes at equipment vary from the pipe size indicated on the Drawings, provide appropriate reducers/increasers directly adjacent to the pipe-equipment unions.

I. Unless otherwise specified herein or indicated on the Drawings, the size of the valves, piping, and accessories dedicated to a piece of equipment shall not be less than the pipe size to which they are connected.

### 3.03 HANGERS AND SUPPORTS:

A. General:

B. Hangers and Supports:

C. Channel Struts:

D. Insulated Piping:

E. Horizontal Support Spacing:

F. Vertical Support Spacing:

G. Embedded Concrete Inserts:

### 3.04 SLEEVES:

A. Provide sleeves where pipes pass through walls, floors and roofs, except in the following circumstances:

B. Sleeves shall be placed into position prior to wall, floor, or roof construction. Sleeves shall be tight-fitting and cut smooth.

C. Floor sleeves shall be cast in place, watertight, and extend from the bottom of the slab to 2" above the finished floor.

D. Wall sleeves shall extend 1" on each side of walls.

E. Make sleeves through outside walls above and below grade watertight, and provide stainless steel escutcheons inside and outside.

F. Size sleeves to have a minimum of 1" annular space to the outside diameter of pipe and/or the pipe insulation, except as follows:
   1. Sleeves in nonrated construction shall be sized to provide clearance all around pipe, including insulation, to accommodate thermal movement. Clearance shall be minimum 0.75".
   2. Sleeves for borosilicate glass piping shall be 2" larger than pipe diameter.

G. Furnish 4 psf lead flashing for sleeves through flat built-up roofs extending at least 8" from the sleeve in all directions.

### 3.05 PENETRATION SEALS:

A. General:
   1. Install in accordance with the manufacturer's published instructions to achieve ratings and classifications specified herein. A copy of these instructions shall be maintained and available on site.

B. Firestops:
   1. Close and firestop abandoned penetrations and penetrations through fire- and smoke-rated construction. Materials used to seal these penetrations shall continue the construction’s fire and smoke resistance ratings uninterrupted and shall maintain an effective barrier against the spread of flame, smoke, water and hot gases. Install after installation of piping and conduits.

C. Exterior Wall Seals:
   1. Piping without insulation: use expansion seals between pipes and sleeves. Where walls exceed the width of expansion seals, use two seals, one being flush with the inside sleeve.
face and the second with the outside sleeve face. Fill the annular void space between the two seals.

2. Piping with insulation: pack center annular space between the insulation and the sleeve with fiberglass, then caulk 1" deep from each face to the fiberglass with nonhardening sealant. Smooth sealant with face of sleeve.

3.06 IDENTIFICATION OF PIPING:

A. Labels shall be on the lower quarters of horizontal piping, except where such location would be obscured and at the plane of observation on vertical piping.

B. Wrap arrow tape completely around the pipe at each end of the label, with arrows pointing in direction of flow.

C. Locate pipe labels as follows:
   1. Within mechanical rooms and above suspended ceilings, and below raised floors:
      a. Within 18" of each valve or valve assembly.
      b. Within 36" of tees at both main and branch.
      c. Within 36" of each 90º elbow.
      d. Not over 20' intervals along horizontal piping.
      e. At midpoint on vertical risers where visible.
      f. Within 18" on each side of a wall.
      g. Within 36" of connections to equipment or vessels.
   2. Piping concealed in chases or shafts:
      a. Each pipe visible through an access door or panel on each level.
   3. Piping exposed in finished rooms:
      a. Omit identification of piping 0.5" and smaller exposed at connections to equipment or plumbing fixtures.
      b. With the above exception, identify not less than 1 point on each piping run visible in each room with identification on not over 20' intervals.

D. Piping with temperature maintenance cable shall be additionally labeled, "Electronically Traced" on the outside of the insulation jacket.

E. Schedule of Piping Identification:

<table>
<thead>
<tr>
<th>PIPING SYSTEM</th>
<th>COLOR CODING</th>
<th>BACKGROUND/LETTER</th>
<th>LEGEND ING</th>
</tr>
</thead>
<tbody>
<tr>
<td>DRAINAGE SYSTEMS</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>FOOD SERVICE WASTE</td>
<td>GREEN/WHITE</td>
<td>FOOD SERVICE WASTE</td>
<td></td>
</tr>
<tr>
<td>FOOD SERVICE VENT</td>
<td>GREEN/WHITE</td>
<td>FOOD SERVICE VENT</td>
<td></td>
</tr>
<tr>
<td>SANITARY</td>
<td>GREEN/WHITE</td>
<td>SANITARY</td>
<td></td>
</tr>
<tr>
<td>WASTE</td>
<td>GREEN/WHITE</td>
<td>WASTE</td>
<td></td>
</tr>
<tr>
<td>VENT</td>
<td>GREEN/WHITE</td>
<td>VENT</td>
<td></td>
</tr>
<tr>
<td>RAINWATER</td>
<td>GREEN/WHITE</td>
<td>RAINWATER</td>
<td></td>
</tr>
<tr>
<td>SECONDARY RAINWATER</td>
<td>GREEN/WHITE</td>
<td>SECONDARY RAINWATER</td>
<td></td>
</tr>
<tr>
<td>PUMPED DISCHARGE</td>
<td>GREEN/WHITE</td>
<td>PUMPED DISCHARGE</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>WATER SYSTEMS</th>
<th>COLOR CODING</th>
<th>BACKGROUND/LETTER</th>
<th>LEGEND ING</th>
</tr>
</thead>
<tbody>
<tr>
<td>COLD WATER</td>
<td>GREEN/WHITE</td>
<td>DOMESTIC COLD WATER</td>
<td></td>
</tr>
<tr>
<td>HOT WATER</td>
<td>GREEN/WHITE</td>
<td>DOMESTIC HOT WATER</td>
<td></td>
</tr>
<tr>
<td>HOT WATER CIRCULATING</td>
<td>GREEN/WHITE</td>
<td>DOMESTIC HOT WATER</td>
<td>CIRCULATION</td>
</tr>
<tr>
<td>TEPID WATER</td>
<td>GREEN/WHITE</td>
<td>TEPID WATER</td>
<td></td>
</tr>
<tr>
<td>NON-POTABLE WATER</td>
<td>YELLOW/BLACK</td>
<td>NON-POTABLE WATER</td>
<td></td>
</tr>
</tbody>
</table>

Bidding Documents - October 31st 2018  22 0010 - 7  PLUMBING GENERAL
### SPECIALTY SYSTEMS

<table>
<thead>
<tr>
<th>System Name</th>
<th>Color Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gray Water Waste</td>
<td>Purple/White</td>
</tr>
<tr>
<td>Gray Water Supply</td>
<td>Purple/White</td>
</tr>
<tr>
<td>Gray Water System Dye</td>
<td>Orange/Black</td>
</tr>
<tr>
<td>Chlorine</td>
<td>Orange/Black</td>
</tr>
<tr>
<td>Compressed Air</td>
<td>Blue/White</td>
</tr>
<tr>
<td>Compressed Air Intake</td>
<td>Blue/White</td>
</tr>
<tr>
<td>Hydronic Solar Supply</td>
<td>Orange/Black</td>
</tr>
<tr>
<td>Hydronic Solar Return</td>
<td>Orange/Black</td>
</tr>
<tr>
<td>Reuse Water</td>
<td>Purple/White</td>
</tr>
<tr>
<td>Vacuum Cleaning</td>
<td>White/Black</td>
</tr>
<tr>
<td>Vacuum Cleaning Exhaust</td>
<td>White/Black</td>
</tr>
<tr>
<td>Pool Supply</td>
<td>Orange/Black</td>
</tr>
<tr>
<td>Pool Return</td>
<td>Orange/Black</td>
</tr>
<tr>
<td>Pool Main Drain</td>
<td>Orange/Black</td>
</tr>
<tr>
<td>Pool Gutter Drain</td>
<td>Orange/Black</td>
</tr>
</tbody>
</table>

### FUEL GAS SYSTEMS

<table>
<thead>
<tr>
<th>System Name</th>
<th>Color Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Natural Gas</td>
<td>Yellow/Black</td>
</tr>
<tr>
<td>Natural Gas Vent</td>
<td>Yellow/Black</td>
</tr>
<tr>
<td>Propane Gas</td>
<td>Yellow/Black</td>
</tr>
</tbody>
</table>

### MEDICAL SYSTEMS

<table>
<thead>
<tr>
<th>System Name</th>
<th>Color Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Medical Air</td>
<td>Yellow/Black</td>
</tr>
<tr>
<td>Medical Air Intake</td>
<td>Yellow/Black</td>
</tr>
<tr>
<td>Medical Vacuum</td>
<td>White/Black</td>
</tr>
<tr>
<td>Medical Vacuum Exhaust</td>
<td>White/Black</td>
</tr>
<tr>
<td>Waste Anesthesia Gas Disposal</td>
<td>Violet/White</td>
</tr>
<tr>
<td>Oxygen</td>
<td>Green/White</td>
</tr>
<tr>
<td>Nitrous Oxide</td>
<td>Blue/White</td>
</tr>
<tr>
<td>Nitrogen</td>
<td>Black/White</td>
</tr>
<tr>
<td>Carbon Dioxide</td>
<td>Gray/White</td>
</tr>
<tr>
<td>Medical Gas Alarm Conduit</td>
<td>Yellow/Black</td>
</tr>
<tr>
<td>Alarm Panel Sensor Conduit</td>
<td>Yellow/Black</td>
</tr>
</tbody>
</table>

### LABORATORY SYSTEMS

<table>
<thead>
<tr>
<th>System Name</th>
<th>Color Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pure Water</td>
<td>Green/White</td>
</tr>
<tr>
<td>Distilled Water</td>
<td>Green/White</td>
</tr>
<tr>
<td>Deionized Water</td>
<td>Green/White</td>
</tr>
<tr>
<td>Deionized Water</td>
<td>Green/White</td>
</tr>
<tr>
<td>Chemical Resisting Waste</td>
<td>Orange/Black</td>
</tr>
<tr>
<td>Chemical Resisting Vent</td>
<td>Orange/Black</td>
</tr>
<tr>
<td>Laboratory Compressed Air</td>
<td>Blue/White</td>
</tr>
<tr>
<td>Laboratory Cylinder Air</td>
<td>Blue/White</td>
</tr>
<tr>
<td>Laboratory Air Intake</td>
<td>Blue/White</td>
</tr>
<tr>
<td>Laboratory Vacuum</td>
<td>White/Black</td>
</tr>
<tr>
<td>Laboratory Vacuum Exhaust</td>
<td>White/Black</td>
</tr>
<tr>
<td>Acetylene</td>
<td>Yellow/Black</td>
</tr>
</tbody>
</table>
ARGON BLACK/WHITE ARGON
CARBON DIOXIDE BLACK/WHITE CARBON DIOXIDE
HELIUM BLACK/WHITE HELIUM
HYDROGEN YELLOW/BLACK HYDROGEN
NITROGEN BLACK/WHITE NITROGEN
NITROUS OXIDE BLACK/WHITE NITROUS OXIDE
OXYGEN WHITE/GREEN OXYGEN

PETROLEUM, OIL AND LUBRICANT SYSTEMS

GASOLINE YELLOW/BLACK GASOLINE
GASOLINE TANK VENT YELLOW/BLACK GASOLINE VENT
FUEL OIL BROWN/WHITE FUEL OIL
DIESEL OIL BROWN/WHITE DIESEL OIL
WASTE OIL BROWN/WHITE WASTE OIL
OIL TANK VENT BROWN/WHITE OIL TANK VENT

3.07 VALVE TAGS AND SCHEDULES:
A. Provide numbered brass tags on valves except at plumbing fixtures. Attach tags to valve stems with brass S-hooks or brass chain.
B. Valves in medical gas systems shall be identified as required by NFPA 99-2015.

3.08 IDENTIFICATION OF EQUIPMENT:
A. General:
   1. Identification shall consist of upper case letters.
   2. Each piece of equipment shall be appropriately identified by nameplates with 0.25" high letters.
      a. Identification shall include the equipment designation and device function, e.g., Water Pressure Booster Pump, WPB-1.

3.09 EQUIPMENT AND EQUIPMENT ROOMS:
A. Remove dust, dirt, rust, stains, and temporary covers.
B. Foreign matter shall be blown, vacuumed, flushed, or cleaned out of and from new equipment, fixtures, floor drains, piping, pumps, motors, bearings, devices, switches, controls, and panels.
C. Clean and polish identification plates.
D. In equipment rooms, clean equipment, insulation, piping, conduit, and room surfaces from dust and dirt and maintain in a clean condition from date of substantial completion the Architect's final certificate until final completion of work and corrective work.
E. Remove excess material from the Project site.

3.10 FOUNDATIONS:
A. Provide concrete foundations for the following floor-mounted equipment:

<table>
<thead>
<tr>
<th>EQUIPMENT</th>
<th>FOUNDATION</th>
</tr>
</thead>
<tbody>
<tr>
<td>WATER HEATERS</td>
<td>4&quot; HIGH PAD</td>
</tr>
<tr>
<td>WATER BOOSTER PUMPS</td>
<td>4&quot; HIGH PAD</td>
</tr>
<tr>
<td>WATER SOFTENERS</td>
<td>4&quot; HIGH PAD</td>
</tr>
<tr>
<td>AIR COMPRESSORS</td>
<td>4&quot; HIGH PAD</td>
</tr>
<tr>
<td>COMPRESSED AIR DRYERS</td>
<td>4&quot; HIGH PAD</td>
</tr>
<tr>
<td>VACUUM PUMPS</td>
<td>4&quot; HIGH PAD</td>
</tr>
<tr>
<td>REUSE WATER SKIDS</td>
<td>4&quot; HIGH PAD</td>
</tr>
<tr>
<td>REUSE WATER TANK</td>
<td>12&quot; HIGH PAD</td>
</tr>
</tbody>
</table>
A. Foundation height shall accommodate seismic anchors, but shall be not less than the minimum specified above.

B. Foundations shall be continuous and shall have beveled edges and smooth flat finish. Foundations shall be reinforced with No. 3 bars a maximum of 12" on center each way, and held in place with dowel rods at each corner anchored in the slab. Dowel rods shall not penetrate through the slab.

C. Roughen and clean exposed slabs before pouring foundations. Apply bonding agent to surfaces in contact.

D. Foundations shall extend a minimum of 6" beyond the equipment footprint or 1.5 times the seismic anchor embedment depth from the point of anchoring (whichever is larger) in all directions, including appurtenances, vibration isolators, base elbow supports, and motors.

E. For equipment attached directly to foundations or inertia bases: and where equipment bases are provided with grout holes, or consist of a structural frame, shall have voids filled with grout after attachment to foundation.

F. Fill voids between baseplates and foundations, and level equipment, with grout.

3.11 ACCESS PANELS - BUILDING:
A. Where plumbing work is concealed by walls or ceilings, or is inaccessible, provide an access panel to provide access for service and maintenance.

B. Plumbing work located above ceilings is considered accessible if the ceiling is the accessible type and is arranged for access to the equipment.

C. Fire-rated access panels shall be provided in fire barriers with ratings to match the construction fire rating.

D. Installation of access panels is specified under another Division.

3.12 ESCUTCHEONS:
A. Provide escutcheons where exposed piping passes through walls, floors and ceilings in finished areas.

3.13 UNDERGROUND WARNING TAPE:
A. During backfill, install tape continuously along length of piping, 12" to 18" above the piping for:
   1. Domestic cold water.
   2. Soil.
   4. Utility located underground, not listed above.

3.14 PAINTING:
A. Except where otherwise specified herein, painting shall be done under another Division. Surfaces shall be left clean and free from oil.

B. Equipment factory finishes damaged or deteriorated during construction shall be repaired to match original finish.

C. Where galvanizing is broken during fabrication or installation, recoat exposed areas with zinc-rich paint.

D. Exterior ferrous equipment, piping and supports shall be painted with 2 coats of rust preventive paint, color selected by the Architect. Engineer.

3.15 EXCAVATION AND BACKFILLING:
A. General:
   1. As applicable to the building and site plumbing work, excavation, shoring, bracing, backfilling, and compaction shall conform to Division 31, Earthwork, except as superseded herein.
   2. The cutting and patching of hardscapes, and restoration of landscapes shall conform to Division 31, Earthwork.
3. Determine exact location of existing underground utilities before excavation. Immediately repair any damage to existing underground utilities at the Contractor's expense.
4. Install underground piping outside the building with 36" minimum cover, unless specified otherwise herein.

B. Excavation:
1. General:
   a. At minimum excavations shall comply with OSHA 29 CFR 1926.651-2016 and 29 CFR 1926.652-2016, or where applicable, an OSHA approved state plan.
   b. Excavations shall be no longer or deeper than necessary.
   c. When the excavated bottom contains rock or any similar material, excavate a minimum of 4" deeper than the required bottom grade, and restore with specified backfill material then compact.
   d. When the bottom is over excavated, backfill to the required bottom grade with specified material then compact.
   e. When the excavated bottom contains non-compactable soil and vegetation, refer to Division 31, Earthwork, for directions in removal and grade restoration.
2. Piping:
   a. Excavate to the pipe's bottom line and grade. Provide recesses for pipe hubs where applicable. Pipe barrels shall be laid full length on firm bedding.
   b. For plastic piping, excavate 4" deeper than the bottom line and grade, then prepare for bedding backfill to restore pipe's bottom line and grade.
3. Structures: excavate to 4" below the bottom grade as indicated on the structure's detail, and prepare for a bed of leveling backfill. Keep the excavation to within the minimum area needed to install or construct the structure.

C. Backfilling:
1. General:
   a. Backfill material shall be free from rocks and debris.
   b. Backfill material where applicable, shall be compactable to a minimum 95% Standard Procter Density.
   c. At any settling of backfill, refill the void area, recompact, and leave level with adjacent grade.
2. Backfill Material:
   a. From excavated grade to 12" above pipe: compaction grade sand, crushed gravel, crushed stone, or rock dust.
   b. From 12" above the pipe to finished grade: compaction grade sand, crushed gravel, crushed stone, rock dust, or excavated material free of rocks over 2" in diameter.
   c. The top 18" under lawn and planting areas is required to be approved planting soil per Project's requirements.
3. Backfill Requirements:
   a. Install backfill evenly in layers not over 6" deep, compacting each layer.
   b. Piping: work backfill material under each lower quarter of pipes, and along barrels, taking caution not to damage pipe material or coating.
   c. Structures: apply backfill material around structures, and bring up to grade in even layers.
4. Compaction:
   a. Compaction inside buildings and in paved areas shall be a minimum 95% Standard Procter Density. In other areas it shall meet the compaction of the adjacent grade.
   b. For all 95% compactions, a third party testing laboratory shall perform compaction test every 30', or fraction thereof, on piping runs, and at every 6' around structures.
   c. Piping: use hand held tampers only around piping to 12" above the pipe. Above 12" hand guided electric tampers may be used. Do not use heavy compaction equipment or machinery which would displace or damage piping.
d. Structures: hand guided electric tampers may be used. Use caution not to damage the structure. Do not use heavy compaction equipment or machinery which would displace or damage structures.
e. Do not use water for compaction.
f. This does not relieve us of responsibility to coordinate.

3.16 COORDINATION:
A. Provide offsets, transitions, and fittings to coordinate the work of each trade with that of other trades, including HVAC, fire suppression, electrical, structural, and architectural.

3.17 OPERATION AND MAINTENANCE MANUALS:
A. These operation and maintenance manual requirements supplement operation and maintenance manual documentation requirements of other Sections of these specifications.
B. Operation and maintenance documentation, in hardback 3-ring loose-leaf binders except full size drawings and CDs, shall cover the plumbing, medical gas, laboratory gas, and fuel systems. Documentation shall include an operations and maintenance documentation directory, emergency information, operating manual, maintenance manual, test reports, and construction documents.
C. The operation and maintenance documentation package shall be submitted as one comprehensive package to the Architect Engineer Owner Using Agency 3 months before systems start-up, and shall be updated, revised and completed at completion of construction.
D. Compile and coordinate the documentation for equipment and systems installed. Documentation shall be typewritten and shall contain, at a minimum, the following information.
1. Introduction:
   a. Project name, contractors' and subcontractors' names, addresses, and telephone and facsimile numbers.
   b. Index.
2. Operations and Maintenance Documentation Directory:
   a. Explanation of the identification system used, including lists of systems, equipment, and component identifiers and names.
3. Emergency Information:
   a. Information for technical and nontechnical personnel about actions recommended during emergency situations to protect life and property and to minimize disruption to the building occupants. Emergencies shall, at a minimum, include:
      1) Fire.
      2) Security breach.
      3) Water outage.
      4) Power failure.
      5) Plumbing overflow or rupture.
      6) Heating failure.
      7) Cooling failure.
4. Operating Manual:
   a. General Information:
      1) Building function.
      2) Building description.
      3) Operating standards and logs.
      4) Technical Information:
         (a) System description.
         (b) Operating routines and procedures.
         (c) Special procedures.
         (d) Basic troubleshooting.
5. Maintenance Manual:
   a. Descriptions (specifications) of the equipment and components.
b. Description of function, as applicable: the function of the equipment, procedures before start-up, functional parameters (input, output) at the design load and at part loads, and performance verification procedures.

c. Recommended maintenance and lubrication procedures and their recommended frequency for this Project.

d. Recommended list of spare parts, part numbers, and the place(s) from which they can be obtained.

e. Original purchase order number; date of purchase; name, address, and the telephone number of the vendor; and warranty information.

f. Installation information.

g. Other information needed for the preparation of documents supporting the management of operation and maintenance programs.

6. Test Reports and Certifications:

a. Copies of tests and certifications performed during manufacture and construction, including but not limited to the following:
   1) Certification of plumbing piping tests.
   2) Results of domestic water system disinfection tests.

7. Construction Documents:

a. Record drawings.

b. Approved submittals, including revised shop drawings indicating as-installed conditions.

c. Equipment identification charts and schedules.

d. Warranty certificates.

e. Inspection certificates.

f. Performance verification report.

E. Submit a receipt signed by the Owner Using Agency acknowledging receipt of the operation and maintenance documentation package.

3.18 RECORD DRAWINGS:

A. A record of field and as-installed conditions shall be maintained at the site, shall be kept current throughout the Project, and shall be used in the preparation of the final record drawings. Field and as-installed conditions shall be recorded on design drawings and shall be marked to include addenda, change orders, field changes and selections made during construction.

B. Upon completion of the Project, submit marked-up design drawings indicating field and as-installed conditions, and shop drawings incorporating changes made during construction for piping and equipment. Submit the following:
   1. sets of bound prints.
   2. Full size PDFs on CDs.

3.19 MAINTENANCE:

A. Equipment operated prior to the date of the Architect's final certificate substantial completion shall be maintained in accordance with manufacturer's recommendations.

B. Prepare and submit a lubrication chart listing for each piece of equipment:
   1. Points requiring lubrication.
   2. Recommendations for a single manufacturer's lubricants with brand name and designation.
   3. Frequency of lubrication required.

C. Lubricate each item of apparatus requiring lubrication prior to start-up in accordance with the manufacturer's recommendations.

3.20 INSTRUCTION OF OPERATING PERSONNEL:

A. Provide the designated Owner's personnel with comprehensive orientation and training in the understanding of the systems and the operation and maintenance of each piece of equipment specified in Division 22. Conduct 2 formal instruction sessions for operating personnel. The first session shall be conducted at the time of start-up and check-out, and the second session shall
be approximately 2 months later. Sessions shall be a minimum of 2 days for basic plumbing systems, and as specified herein for specialty systems and equipment. Sessions shall be conducted at the site.

B. Prepare and submit a syllabus describing an overview of the proposed training program, describing how the training program will be conducted, when and where meetings are to be held, names and company affiliations of lecturers, description of contents and outline for each lecture, and recommended reference material and outside reading. Obtain direction from the Architect Engineer Owner Using Agency on which operating personnel shall be instructed in each system. Proposed training schedules, materials, and lesson plans shall be submitted to the Owner for review of the content and adequacy of the training of the Owner's personnel.

C. The appropriate manufacturer's representative shall provide the instructions on each major piece of equipment. This person may be the start-up technician for the piece of equipment, the installing contractor, or manufacturer’s representative. More than one party may be required to execute the training. The training program shall include the following, as appropriate for the system or equipment:

1. Training shall normally start with classroom sessions followed by hands-on training for each piece of equipment, which shall illustrate the various modes of operation, including start-up, shutdown, and power failure.

2. During any demonstration, should the system fail to perform in accordance with the requirements of the operation and maintenance manual or sequence of operations, the system will be repaired or adjusted as necessary and the demonstration repeated.

3. Training shall include:
   a. Use of the printed installation, operation and maintenance instruction material included in the operation and maintenance manuals.
   b. A review of the written operation and maintenance instructions emphasizing safe and proper operating requirements, preventative and routine maintenance, special tools needed and spare parts inventory suggestions. The training shall include start-up, operation in all modes possible, shut-down, seasonal changeover, and any emergency procedures.
   c. Discussion of relevant health and safety issues and concerns.
   d. Discussion of warranties and guarantees.
   e. Common troubleshooting problems and solutions.
   f. Explanatory information included in the operation and maintenance manuals and the location of plans and manuals in the facility.
   g. Discussion of any peculiarities of equipment installation or operation.
   h. Classroom sessions shall include the use of overhead projections, slides, video/audio-taped material as appropriate.
   i. Factory-trained technicians shall give instruction on the following specialty systems and equipment:

4. Hands-on training shall include start-up, operation in all modes possible, including manual, shut-down and any emergency procedures and preventative maintenance for all pieces of equipment.

5. Explain and demonstrate the operation, function and overrides of local packaged controls not controlled by the central control system.

6. Training shall occur after testing is complete, unless approved otherwise by the Architect, Engineer, Owner.

7. Provide DVD format video recordings of training sessions and a complete record copy of training materials, handouts, and other printed materials used in each training session.

8. Obtain a receipt acknowledging completion of each item of instruction.

END OF SECTION
SECTION 22 0090
PLUMBING PERFORMANCE VERIFICATION

PART 1: GENERAL

1.01 DESCRIPTION:

A. General provisions and other plumbing systems are specified in other Sections of Division 22.

B. Refer to Section 22 00 10, Plumbing General for a list of plumbing Sections included in this specification.

C. This Section covers plumbing systems performance verification, as required to demonstrate that the equipment and systems of Division 22 are ready for safe and satisfactory operation, as defined by the Construction Documents. Performance verification shall include, but shall not be limited to, identification of piping and equipment, cleaning, lubrication, start-up, check-out, and testing and adjusting systems, preparation of equipment and systems documentation and of maintenance and operation manuals, Owner training, and preparation of record drawings.

D. Performance verification is an ongoing process and shall be performed throughout construction. Performance verification verifies that systems are operating in a manner consistent with the Construction Documents.

E. Performance verification shall conclude with the completion of required deferred testing, training, and system documentation as specified herein and required to demonstrate the proper operation of the plumbing equipment and systems provided by this Division.

F. Verify, at a minimum, the performance of the following systems and equipment and witness the following tests:

1. Section 22 00 10, Plumbing General:
2. Section 22 42 00, Plumbing Fixtures:
   a. Fixture tests.
   b. Plumbing fixtures.
3. Section 22 43 00, Drainage Systems:
   a. Piping and joint tests.
4. Section 22 44 00, Water Systems:
   a. Backflow preventers.
   b. Mixing valves.
   c. Piping and joint tests.
   d. Pressure reducing valves.
   e. Trap primers.
   f. Water heaters.

1.02 QUALITY ASSURANCE:

A. Provide a Plumbing Performance Verification Supervisor with ten years experience in plumbing contracting. The Plumbing Performance Verification Supervisor shall become familiar with the Owner's project requirements and the requirements of the performance verification process as defined in this Section. and if applicable, the commissioning process defined in Division 29. The Plumbing Performance Verification Supervisor shall coordinate and execute the required performance verification activities.

B. The Plumbing Performance Verification Supervisor shall review submittal data for conformance with the requirements of the Project, shall monitor compliance with the requirements specified herein for storage and protection of equipment during construction, shall authorize the initial starting of equipment and systems in a manner to avoid damage to equipment, shall oversee start-up, testing and balancing, and shall document that the scheduled and specified performance requirements of each system have been accomplished.

C. Refer to ASHRAE Guideline 0.2-2015, Commissioning Process for Existing Systems and Assemblies, and Guideline 4-2008 (RA 2013), Preparation of Operating and Maintenance Documentation for Building Systems.
1.03 PERFORMANCE VERIFICATION RESPONSIBILITIES:

A. The Plumbing Performance Verification Supervisor shall be responsible for scheduling, supervising, and coordinating and executing the start-up, testing, and performance verification activities as specified herein. Include and itemize the cost of performance verification in the contract price, and in each purchase order or subcontract written, include requirements for submittal data, performance verification efforts and documentation, operations and maintenance data, and training as specified herein.

B. Plumbing performance verification shall take place in three phases. Performance verification requirements for each phase are as follows:

1. Construction Phase:
   a. Attend a performance verification scoping meeting and additional such meetings, initially scheduled monthly until prefunctional testing of equipment and systems begins, and weekly thereafter during the construction phase to facilitate the performance verification process. The Plumbing Performance Verification Supervisor shall coordinate meeting attendance with the Commissioning Authority.
   b. Report in writing to the Architect, Engineer, Owner, Commissioning Authority at least as often as performance verification meetings are scheduled, concerning the status of plumbing activities as they affect the performance verification process, the status of each discrepancy identified the prefunctional and functional testing process, explanations of any disagreements with the identified deficiencies, and the proposed resolution and schedule for correction of the deficiency.
   c. Provide documentation of installed systems and equipment, and develop functional testing procedures. This documentation shall include detailed manufacturer installation, start-up, operating, troubleshooting and maintenance procedures; full details of any Owner-contracted tests; pump curves; full factory testing reports, if any; and full warranty information, including responsibilities of the Owner to keep the warranty in force. In addition, the installation, start-up and check-out materials that are actually shipped inside the equipment and the actual field check-out sheet forms to be used by the factory or field technicians shall be submitted to the Architect, Engineer, Owner, Commissioning Authority.
   d. Develop and submit to the Architect Engineer Owner Commissioning Authority for review and comment, prior to equipment or system start-up, a complete start-up and initial check-out plan using manufacturer's start-up procedures and prefunctional checklists for the performance of the equipment to be verified.
   e. Assist in clarifying the proposed operation and control of equipment in areas where the specifications, control drawings or equipment documentation is not sufficient for writing detailed testing procedures.
   f. Prepare the specific functional test procedures as specified herein and review the proposed functional test procedures to ensure feasibility, safety, and equipment protection, and provide necessary written alarm limits to be used during the tests. Obtain Architect Engineer Owner Commissioning Authority approval for proposed functional test procedures.
   g. Prepare a preliminary schedule for performance verification activities, including pipe and system pressure and leakage testing, flushing and cleaning, equipment start-up, and testing, and update the schedule during the construction period, as appropriate. Notify the Architect Engineer Owner Commissioning Authority immediately when the performance verification activities not yet performed or not yet scheduled will delay construction.
   h. Plumbing equipment start-up shall not be initiated until completion of pressure and leakage testing and cleaning as specified in other Sections of Division 22.
   i. Provide start-up and prefunctional testing for equipment and execute the plumbing-related portions of the prefunctional checklists for the verification of the performance of all the equipment during the start-up and initial check-out process.
   j. Perform and document start-up and system operational check-out procedures, providing a copy to the Architect, Engineer, Owner, Commissioning Authority.
k. Correct noncompliance items before beginning functional performance testing. Water testing and adjusting shall be completed with discrepancies and problems remedied before functional testing of the respective water-related systems.

2. Acceptance Phase:
   a. Place equipment and systems into operation and continue their operation during each working day of the testing, adjusting and balancing, and performance verification activities, as required.
   b. For each system or area, have required prefunctional checklists, calibrations, start-up and prefunctional tests of the plumbing systems and associated controls completed prior to beginning the testing, adjusting and balancing process.
   c. Provide skilled technicians to execute starting and prefunctional testing of equipment and to execute the functional tests for each individual piece of equipment and system. Technicians shall be available and present during the agreed upon scheduled tests and for sufficient duration to complete the necessary tests, adjustments and problem-solving.
   d. Correct deficiencies (differences between specified and observed performance) as identified by the Plumbing Performance Verification Supervisor or the Commissioning Authority and interpreted by the Architect Engineer and retest the equipment, as required to demonstrate proper operation and performance.
   e. Prepare operation and maintenance manuals as specified herein, including clarifying and updating the original sequences of operation to as-built conditions.
   f. Maintain marked-up record drawings and produce final record drawings of Project drawings and contractor-generated coordination drawings. List and identify on these record drawings the locations of control system components, and sensor installations that are not equipment mounted.
   g. Provide specified training of the Owner’s operating personnel.
   h. Coordinate with equipment manufacturers to determine specific requirements to maintain the validity of the warranty.

3. Warranty Period:
   a. Execute deferred functional testing.
   b. Correct deficiencies and make necessary adjustments to operations and maintenance manuals and as-built drawings system or equipment modifications made during the warranty period and those identified in any deferred functional performance testing.

PART 2: PRODUCTS

2.01 TEST EQUIPMENT:

   A. Standard testing equipment required to perform start-up, initial check-out, prefunctional, and required functional testing shall be provided for the equipment or system being tested.
   B. Test equipment shall be of the quality and accuracy required to test and/or measure system performance with the tolerances specified and shall have been calibrated within the last 12 months, or as specified herein. Equipment shall be calibrated according to the manufacturer’s recommended intervals and when dropped or damaged. Calibration tags shall be affixed or certificates available on request.

   1. Temperature sensors and digital thermometers shall have a certified calibration within the past 12 months and a resolution of ±0.1°F. Accuracy of temperature test equipment shall be at least twice that of the instrumentation being tested.
   2. Pressure sensors shall have a certified calibration within the 12 months and a resolution of 0.05% of sensor range. Accuracy of pressure test equipment shall be at least twice that of the instrumentation being tested.
   3. Accuracy of other sensors shall be at least twice that of the instrumentation being tested.
PART 3: EXECUTION

3.01 SUBMITTALS:

A. Submit additional documentation as required to support the performance verification process. This additional submittal documentation shall include, at a minimum, the proposed start-up and initial check-out procedures, and prefunctional checklists.

3.02 START-UP PLAN AND PREFUNCTIONAL TESTING:

A. Prefunctional testing shall be required for each piece of equipment to ensure that the equipment and systems are properly installed and ready for operation, so that functional testing may proceed without delays. Follow the approved start-up, initial check-out, and prefunctional testing procedures. Sampling strategies shall not be used for prefunctional testing. The prefunctional testing for equipment and subsystems of a given system shall be successfully completed and documented prior to functional testing of the system.

B. Procedures for performance verification shall include:

1. Start-up and initial check-out plan: develop the detailed start-up and prefunctional testing plans for equipment and systems that are to be performance verified, as specified herein. Review the proposed procedures and prefunctional testing documentation to ensure that there is written documentation that each of the manufacturer-recommended procedures have been completed.

2. The start-up and initial check-out plan shall consist, as a minimum, of the following:
   a. The manufacturer's standard written start-up and check-out procedures copied from the installation manuals and manufacturer's normally used field check-out sheets. The plan shall include checklists and procedures with specific boxes or lines for recording and documenting the checking and inspections of each procedure and a summary statement with a signature block at the end of the plan.
   b. First-run checklist for equipment, including:
      1) Equipment properly set.
      2) Alignment of shafts and couplings.
      3) Adjustment of vibration isolators.
      4) Piping and equipment properly connected.
      5) Completion of initial lubrication procedures.
      6) Wiring properly connected.
      7) Electrical overload relays appropriate for load.
      8) Electrical accessories properly installed and adjusted.
      9) Controls, safeties, and time switches properly set.
     10) Verification of direction of motor rotation after final electrical connections by jogging motor.
     11) Measurement of ampere draw of electric motors and comparison with nameplate rating and with overload heater ratings.
     12) Monitoring of temperature build-up in motors and bearings.
   c. Contractor-developed prefunctional checklists.

3. Identify which entity is responsible for executing and documenting each of the line item tasks and note that trade on the form. Each form may have more than one trade responsible for its execution.

C. Four weeks prior to start-up, schedule equipment and systems start-up and check-out and notify the Architect Engineer Owner Commissioning Authority in writing. The execution of the prefunctional checklists, start-up and check-out shall be directed and performed by the Contractor, in accordance with manufacturer's published procedures. The Architect Engineer Owner Commissioning Authority shall be present for the start-up, check-out, and prefunctional testing of the first unit of each type of equipment, and any other tests he designates.

D. Sensor calibration: calibration of sensors associated with a given piece of equipment or system shall be included as part of the prefunctional testing and listed on the appropriate test checklists and reports for the system.
E. Completed start-up, check-out, and prefunctional test forms shall be completed and submitted to the Architect Engineer Owner Commissioning Authority for review. List outstanding items of the initial start-up and prefunctional procedures that were not completed successfully, at the bottom of the procedures form or on an attached sheet. The procedures form and any outstanding deficiencies shall be provided to the Architect Engineer Owner Commissioning Authority within 2 days of test completion. The Architect Engineer Owner Commissioning Authority shall review the Contractor's start-up and prefunctional testing reports and shall submit either a noncompliance report or an approval form to the Contractor. The Contractor shall correct items that are deficient or incomplete in the checklists and tests in a timely manner, and shall notify the Architect Engineer Owner Commissioning Authority as soon as outstanding items have been corrected and resubmit an updated start-up report and a statement of correction on the original noncompliance report. When requirements are completed, the Architect Engineer Owner Commissioning Authority shall recommend approval of the start-up and prefunctional testing of each system and schedule the functional testing of the equipment or system.

F. Complete start-up and prefunctional testing for a system before functional test of that system may proceed.

3.03 RETESTING OF EQUIPMENT AND/OR SYSTEMS:

A. Provide labor and materials required for retesting of any functional test found to be deficient.

B. Prior to retesting, submit required data indicating that the deficient items have been completed and/or corrected to the Architect Engineer Owner Commissioning Authority for approval and rescheduling of the functional test. If during the retesting it becomes apparent that the deficient items have not been completed and/or corrected as indicated in the data provided by the Contractor, the retesting shall be stopped. Costs for the design team to further supervise the retesting of a functional test shall be the responsibility of the Contractor.

3.04 DEFERRED TESTING:

A. Schedule and coordinate, with the approval of the Architect, Engineer, Owner, Commissioning Authority, tests delayed until building construction is completed, required building occupancy or loading, weather, or other conditions are suitable for the demonstration of equipment or system's performance, as specified herein. Deferred testing shall be executed, documented, and deficiencies corrected as specified herein for functional testing.

3.05 TESTING DOCUMENTATION, NONCONFORMANCE, AND APPROVALS:

A. List outstanding items of the initial start-up and prefunctional procedures that were not completed successfully, at the bottom of the functional test procedure forms or on an attached sheet. The functional test procedure forms and any outstanding deficiencies shall be provided to the Architect Engineer Owner Commissioning Authority within 2 days of test completion. The Architect Engineer Owner Commissioning Authority shall review the Contractor's start-up and prefunctional testing documentation and shall submit either a noncompliance report or an approval form to the Contractor. Work with the Architect Engineer Owner Commissioning Authority to correct and retest deficiencies or uncompleted items. Correct items that are deficient or incomplete in a timely manner, and notify the Architect Engineer Owner Commissioning Authority as soon as outstanding items have been corrected and resubmit an updated start-up report and a statement of correction on the original noncompliance report. When requirements are completed, schedule the functional testing of the equipment or system.

B. As functional performance testing progresses and deficiencies are identified, work with the Architect Engineer Owner Commissioning Authority to resolve the issues.

3.06 OPERATION AND MAINTENANCE MANUALS:

A. The Plumbing Performance Verification Supervisor shall compile and prepare documentation for equipment and systems covered in Division 22 and deliver this documentation for inclusion in the operation and maintenance manuals prior to the training of the Owner's personnel.
3.07 INSTRUCTION OF OPERATING PERSONNEL:
   A. The Plumbing Performance Verification Supervisor shall schedule, coordinate and assemble, and deliver the documentation of training required by Division 22.

3.08 FUNCTIONAL TESTS:
   A. Functional test requirements for the demonstration of proper system and equipment operation shall be defined by the Plumbing Performance Verification Supervisor. Execution of these test and demonstration of the required performance shall be the responsibility of the Contractor, under the direction of the Commissioning Authority.
   B. Functional testing is intended to begin upon completion of a system. Functional testing may proceed prior to the completion of systems or subsystems at the discretion of the Plumbing Performance Verification Supervisor, Architect, Engineer, Owner, Commissioning Authority. Beginning system testing before full completion of construction shall not relieve the Contractor from fully completing the system, including prefunctional checklists.
   C. Functional testing shall be completed and test documentation approved by the Architect, Engineer, Owner, Commissioning Authority before the Project will be considered substantially complete.

END OF SECTION
PART 1: GENERAL

1.01 DESCRIPTION:
A. General provisions and other plumbing systems are specified in other Sections of Division 22.
B. Refer to Section 22 00 10, Plumbing General, for a list of plumbing Sections included in this specification.
C. This Section covers thermal insulation for plumbing piping and equipment.
D. Items not to be insulated:
   1. Chrome plated water supplies to plumbing fixtures. See Section 22 42 00, Plumbing Fixtures for insulation of water supplies to ADA fixtures.
   2. Underground domestic cold water piping.
   3. Domestic cold water piping.

1.02 QUALITY ASSURANCE:
A. Conform to the following:
B. Products of the manufacturers listed will be acceptable for use for the specific functions specified herein. Materials shall be compatible with the materials to which they are applied, and shall not corrode, soften or otherwise attack such material in either the wet or dry state.
C. Materials shall be applied subject to their temperature limits. Methods of application of insulating materials or finishes not specified in detail herein shall be in accordance with the particular manufacturer's published recommendations.
D. Insulation shall be applied by experienced workers regularly employed for this type of work.

1.03 RATINGS:
A. Insulation and accessories, unless specifically excepted herein, shall have a maximum composite flame spread rating of 25 and a maximum smoke developed rating of 50. Materials that are factory-applied shall be tested as assembled. Materials which are field-applied may be tested individually. No fugitive or corrosive treatments shall be employed to impart flame resistance.
B. Flame spread and smoke developed ratings shall be in accordance with ASTM E84-2016. Products or their shipping cartons shall bear a label indicating flame spread and smoke developed ratings.
C. Treatment of pipe jackets to impart flame and smoke safety shall be permanent. The use of water-soluble treatments is prohibited.
D. Vapor retarders shall have a maximum permeance of 0.02 perm at 73.4°F.

1.04 ALTERNATE THICKNESSES:
A. Specified thicknesses may be increased or reduced for insulation materials having thermal resistivity, K-values, different from those listed. Submit calculations in accordance with ASHRAE/IES 90.1-2016, and documentation of product performance.

PART 2: PRODUCTS

2.01 INSULATION:
A. Fiberglass Pipe and Blanket Insulation:
   1. Pipe insulation: maximum K-value for preformed pipe insulation: 0.23 Btu·in/(h·ft²·°F) at 75°F.
      a. Manufacturer: CertainTeed, Johns Manville, Knauf, Manson Insulation, or Owens Corning.
B. Cellular Glass Insulation:
1. Insulation: maximum K-value: 0.29 Btu·in/(h·ft²·°F) at 75°F.
   a. Manufacturer: Pittsburgh Corning Foamglas.
2. Joint Sealant:
   a. Manufacturer: Blackhawk Seal-Kote, or Pittsburgh Corning Pittseal.
3. Fittings: preformed fittings with the maximum K-value: 0.29 Btu·in/(h·ft²·°F) at 75°F.
   a. Manufacturer: Pittsburgh Corning Foamglas.
   a. Manufacturer: Pittsburgh Corning Pittwrap CW.

2.02 ACCESSORIES:
A. Adhesives and Mastics:
   1. Manufacturer: Aeroflex, Armacell, Childers, Epolux, Foster, Marathon, Pittsburg Corning PC 88, Pittsburgh Corning Pittcote 300 (interior) or 404 (exterior), or Vimasco.
B. Insulating Cement:
   1. Mineral wool type, asbestos free, maximum K-value of 0.20 Btu·in/(h·ft²·°F) at 75°F.
   2. Manufacturer: Industrial Insulation Group CalCoat-127, or Ramco Ramcote 1200.
C. Glass fabric: 10 x 10 threads per square inch construction white fiberglass scrim fabric.
D. Tape: pressure sensitive, foil-scrim-kraft backed.

2.03 ALUMINUM JACKETING:
A. Piping and tanks: corrugated aluminum jackets, 0.016" thick with an embossed finish, and a factory heat laminated 3 mil moisture retarder film on the inner surface, and meeting ASTM B209-2014.
B. Fittings: stamped 2-piece (matching halves) aluminum fitting covers and end caps, 0.024" thick, with a factory heat lamination moisture retarder film on the inner surface.

PART 3: EXECUTION
3.01 GENERAL:
A. Surfaces to be insulated shall be clean, dry, and free of foreign material, rust, scale and dirt when insulation is applied.
B. Perform pressure and leakage tests and submit results required by other Sections before applying insulation.
C. Where existing insulation is damaged due to the new work, repair damage to match existing work or replace damaged portion with insulation specified for new work.
D. On piping where temperature maintenance cable is specified, to ensure the insulation’s adequate fit, increase the insulation size as required to comply with the cable manufacturer’s installation instructions.

3.02 INSULATION FOR TEMPERED, HOT, AND HOT WATER CIRCULATING PIPE:
A. Insulate the following pipe with preformed fiberglass pipe insulation of the thickness indicated, with vapor retarder and white all service jacket with self-sealing lap:

<table>
<thead>
<tr>
<th>INSULATION THICKNESS, INCHES</th>
<th>FLUID DESIGN OPERATING TEMPERATURE RANGE, °F</th>
<th>PIPE SIZES 0.5&quot;- 1.25&quot;</th>
<th>1.5&quot;- 6&quot;</th>
</tr>
</thead>
<tbody>
<tr>
<td>TEMPERED WATER AND TEMPERED WATER CIRCULATING</td>
<td>85 TO 109</td>
<td>1</td>
<td>1</td>
</tr>
</tbody>
</table>

Bidding Documents - October 31st 2018
22 2500 - 2 PLUMBING INSULATION
**HOT WATER AND HOT WATER CIRCULATING**

<table>
<thead>
<tr>
<th>Temperature</th>
<th>Thickness</th>
<th>Insulation</th>
</tr>
</thead>
<tbody>
<tr>
<td>110 TO 140</td>
<td>1</td>
<td>1.5</td>
</tr>
</tbody>
</table>

**HIGH TEMPERATURE HOT WATER**

<table>
<thead>
<tr>
<th>Temperature</th>
<th>Thickness</th>
<th>Insulation</th>
</tr>
</thead>
<tbody>
<tr>
<td>141 TO 180</td>
<td>1.5</td>
<td>2</td>
</tr>
</tbody>
</table>

A. Install insulation with jacket drawn tight and side laps and end joint butt strips secured. End joint butt strips shall be minimum 3" wide and of material identical to jacket. Seal ends of insulation at fittings, valves, and riser clamps.

B. Insulate fittings, flanges, strainers, unions, and valve bodies with packing nut and stem left open, with preformed or mitered fiberglass. Wire fiberglass in-place and cover with a smoothing coat of insulating cement. Finish with glass fabric embedded into a coat of white breather mastic. Glass fabric shall overlap adjoining insulation at least 2".

C. Do not insulate unions.

### 3.03 INSULATION FOR COLD PIPE:

A. Insulate the following pipe with preformed fiberglass pipe insulation of the thickness indicated, with vapor retarder, white all service jacket, and self-sealing lap:
   1. Domestic cold water above grade, 0.5" thick.
   2. Water cooler waste, trap, and waste arm to vertical stack, 1" thick.
   3. Chilled drinking water, supply and return, 1" thick.
   4. Branch waste, including drain and P-trap, receiving drainage from air conditioning and boiler equipment, and cooler/freezer equipment, 1.5" thick.

### 3.04 ACCESSORIES:

A. Adhesives and Mastics:
   1. Seal open ends of insulation with a thick mastic coating.

B. Insulating Cement:
   1. Install a minimum 0.5" thick coat with a smooth finish, and even with the adjacent insulation.

C. Tape:
   1. When applied to jacket insulation, wrap tape as tight as possible without crushing the insulation jacket.

D. Fitting Jackets:
   1. Installation in mechanical rooms and exterior locations only.

E. Coal Tar:
   1. Apply to underground piping to:
      a. Isolate copper from masonry or concrete flooring.
      b. Repair slightly damaged pipe-wrap for gas piping.
      c. Repair slightly damaged cellular glass insulation jacketing.

### 3.05 INSTALLATION:

A. Install insulation after piping has been tested and approved.

B. Insulation shall be clean and dry during installation and during application of any finish.

C. Provide removable and replaceable covers on equipment, and removable ends of strainers requiring insulation, that must be opened periodically for inspection, cleaning, or repair.

D. Install insulation materials with smooth and even surfaces, jackets drawn tight and cemented down smoothly at longitudinal and end laps. Do not use scrap pieces of insulation where a full length section will fit.

E. Install insulation, jackets and coatings continuous through openings and sleeves in nonrated construction. For penetrations of fire- or smoke-rated construction, insulation shall be butted tightly against firestops specified in Section 22 00 10, Plumbing General. Tape butt joints.
F. Banding wires shall have the twisted terminals turned down toward the insulation without damaging the vapor retarder.

3.06 INSULATION PROTECTION:

A. Protect interior fiberglass piping insulation exposed to damage with a corrugated aluminum jacket. Locate the longitudinal joints to shed water, and secure with aluminum bands at end joints and every 12" on center. Tightly abut end joints together. Install aluminum fitting-covers over fittings, overlapping the adjacent butt ends of the piping's aluminum jacket. Secure with aluminum bands.

B. Protect interior site insulated tanks with a corrugated aluminum jackets. Install jacketing taut around tank overlapping seams by 3", and tightly abutting end joints together. Secure with aluminum bands at end joints and every 12" on center.

C. Protect exterior piping insulation, except flexible elastomeric, with a corrugated aluminum jacket. Locate the longitudinal joints to shed water, and secure with aluminum bands at end joints and every 12" on center. Provide a 2" overlap at each end joint and seal with joint sealant. Install aluminum fitting-covers over fittings, overlapping the adjacent butt ends of the piping's aluminum jacket. Seal with joint sealant, and secure fitting covers with aluminum bands.

D. Protect exterior flexible elastomeric insulation with a UV resistant white acrylic latex coating.

END OF SECTION
SECTION 22 4200
PLUMBING FIXTURES

PART 1: GENERAL

1.01 DESCRIPTION:
A. General provisions and other mechanical systems are specified in other Sections of Division 22.
B. Refer to 22 00 10, Plumbing General, for a complete list of plumbing sections included in this specification.
C. This Section covers plumbing fixtures, trim and related equipment.

1.02 QUALITY ASSURANCE:
A. Conform to the following:
   1. All applicable codes referenced in 22 00 10, Plumbing General.
   3. Americans with Disabilities Act (ADA) - 1990 (Revised 2008).
   5. Wetted components in the potable water (fixture) system, where the water is anticipated for human consumption shall comply with the Reduction of Lead in Drinking Water Act - 2011.

1.03 PLUMBING FIXTURES - GENERAL:
A. Fixtures shall have smooth impervious surfaces, free from defects with no concealed fouling surfaces, and be Grade-A quality. Fixtures shall comply with ASME A112.19.1/CSA B45.2-2013, ASME A112.19.2/CSA B45.1-2013, ASME A112.19.3/CSA B45.4-2008, and ASME A112.19.5/CSA B45.15-2011. The name or trademark of the manufacturer is required to be printed on or pressed into the fixtures. In addition, a label which cannot be removed without destroying it, containing the manufacturer's name or trademark, and the quality or class of the fixture, shall be affixed to fixtures and not removed until after the work is accepted.
B. Exposed waste and supply piping, including piping exposed when millwork doors are open, and mounting bolts of fixtures shall be chromium-plated.
C. All faucets, flush valves, and associated trim shall be chromium-plated.
D. Fixtures and trim of the same construction shall be by the same manufacturer, e.g., vitreous china, water fountains, stainless steel, flush valves, and supplies, etc., unless otherwise specified herein.
E. Vitreous china fixtures shall be white.
F. Plumbing fixtures shall be complete, with installation, and all fittings, trim, and equipment to provide for proper operation and usage, as defined by the product manufacturers, industry standards, and applicable codes.
PART 2: PRODUCTS

2.01 WATER CLOSETS AND TRIM: SEE PLUMBING FIXTURE CONNECTION SCHEDULE ON DRAWINGS

2.02 LAVATORIES AND TRIM: SEE PLUMBING FIXTURE CONNECTION SCHEDULE ON DRAWINGS

2.03 URINALS AND TRIM: SEE PLUMBING FIXTURE CONNECTION SCHEDULE ON DRAWINGS

2.04 WATER FOUNTAINS AND TRIM: SEE PLUMBING FIXTURE CONNECTION SCHEDULE ON DRAWINGS

2.05 SERVICE SINKS AND TRIM: SEE PLUMBING FIXTURE CONNECTION SCHEDULE ON DRAWINGS

2.06 COUNTER SINKS AND TRIM: SEE PLUMBING FIXTURE CONNECTION SCHEDULE ON DRAWINGS

2.07 ICE MAKER CONNECTION BOXES: SEE PLUMBING FIXTURE CONNECTION SCHEDULE ON DRAWINGS

PART 3: EXECUTION

3.01 PLUMBING FIXTURES AND TRIM - GENERAL:

A. Fixtures:
   1. Set fixtures level and in alignment with walls.
   2. Caulk between fixtures and mounting surfaces with a white non-hardening
tight and secure all joints.
   3. Reinforce the wall behind wall-hung fixtures with a galvanized steel plate bolted

b. Reinforce the wall behind wall-hung fixtures with a galvanized steel plate bolted

3.02 PLUMBING FIXTURES AND TRIM:

A. Water Closets and Trim - (Series F1):
   1. Fixtures:
      a. Connect floor outlet water closets with cast iron PVC floor flanges. Make the joint
      between the closet outlet and the floor flange with a gasket.
      b. Caulk cast iron closet connectors to the cast iron closet bend or straight closet
      connection.
      c. Trim:
         1) Install flush valves for ADA water closets with the handle manual override on the
            wide side of the toilet stall.
2) Where automatic sensor flush valves are installed, coordinate the distance from the bottom of the ADA grab bar and the highest portion of the flush valve to allow for cap removal and battery replacement.
3) Wrench tighten flush valve stop cover to limit vandalism.

2. Lavatories and Trim - (Series F2):
   a. Fixtures:
      1) For counter top installed lavatories, coordinate with counter top supplier for size of basin opening.
      2) For under-mount lavatories, coordinate with counter top supplier for size of basin opening.
   b. Trim:
      1) Set the flow period for adjustable metering faucets at 15 seconds.
      2) For under-mount lavatories, coordinate with counter top supplier for faucet holes. Coordinate for the faucet to be as close as possible to the basin, for best overhang and use of water spout.

3. Water Fountains and Trim - (Series F4):
   a. Fixtures:
      1) Anchor the bottom of wall-hung water fountains to the wall.
   b. Trim:
      1) Install stop valves for water fountains within the water fountain cabinet.
      2) For electric water coolers, insulate the P-trap and waste to wall.

4. Service Sinks and Trim - (Series F5):
   a. Trim:
      1) Rough-in faucets for floor mounted service sinks at 30" above the floor.
      2) Install wall hung mop hanger on adjacent wall to faucet, centered with fixture, and with bottom at 48" above the floor.

5. Counter Sinks and Trim - (Series F6):
   a. Fixtures:
      1) For sinks installed in counter, coordinate with counter top supplier for size of opening.
      2) For under-mount sinks, coordinate with counter top supplier for basin opening.
   b. Trim:
      1) For under-mount sinks, coordinate with counter top supplier for faucet holes. Coordinate for the faucet to be as close as possible to the basin, for best overhang and use of water spout.
      2) Select 110°F for hospitals or nursing homes, and 115°F for all other installations.

3.03 Fixture Tests:
   A. Test plumbing fixtures for soundness, stability of support, and operation.
   B. Test fixture accessories for smooth operation of handles and hand wheels, and proper operation of flow.
   C. Test flush valves for stability at the wall with no movement.
   D. Test the hot water temperature at each plumbing fixture, and ensure that the correct temperature water is flowing from the system.
   E. Flow all faucets and operate all flush valves until clear water is continuously observed.

3.04 Cleaning:
   A. Clean plumbing fixtures and trim, and plumbing related fixtures, trim, and equipment, with a commercial grade disinfectant cleaner that will not damage the fixtures, trim, or equipment.
   B. Open and clean all faucet aerators/strainers, and flush valve diaphragms/pistons of start-up film and construction debris.

END OF SECTION
PART 1: GENERAL

1.01 DESCRIPTION:
A. General provisions and other plumbing systems are specified in other Sections of Division 22.
B. Refer to Section 22 00 10, Plumbing General, for a list of plumbing Sections included in this specification.
C. This Section covers plumbing drainage, waste and vent systems.

1.02 QUALITY ASSURANCE:
A. Conform to the following:
   1. The following standard is for sites, facilities, buildings, and elements to be made usable by people with physical disabilities.

PART 2: PRODUCTS

2.01 PIPING, FITTINGS, AND JOINTS:
A. Do not use plastic pipe in a return air plenum.
B. Do not use plastic pipe for high temperature drainage from sterilizers, boilers, dishwashers, or cage washers.
C. For any service not listed, check compatibility of piping material and service.
D. General:
E. Soil, waste, vent, and food service waste and vent, 15" and smaller, below slab-on-grade and extending to 5’ outside:
   1. Hub and Spigot Cast Iron pipe and fittings shall be manufactured from gray cast iron and shall conform to ASTM A 74. All pipe and fittings shall be marked with the collective trademark of the Cast Iron Soil Pipe Institute and listed by NSF International.
   2. Joints: made using a compression gasket manufactured from an elastomer meeting the requirements of ASTM C 564 or lead and oakum. All pipe and fittings to be produced by a single manufacturer and are to be installed in accordance with manufacturer’s recommendations and applicable code requirements.
      a. No-hub is available in sizes 1.5", 2", 3", 4", 6", 8", 10", 12", and 15".
F. Soil, waste, vent, and food service waste and vent, 10" and smaller, above slab-on-grade throughout the building:
   1. Piping: no-hub cast iron, petroleum asphaltic-coated inside and out. All hubless Cast Iron pipe shall be manufactured from gray cast iron and shall conform to ASTM A 888 and CISPI Standard 301 and listed by NSF International.
   2. Fittings: All fittings shall be marked with the collective trademark of the Cast Iron Soil Pipe Institute and listed by NSF International, ASTM A888-2015.
   3. Joints:
      a. Standard duty stainless steel couplings for drainage and vent piping to 4": mechanical compression type with neoprene collars conforming to ASTM C564-2014, type 301 or 304 stainless steel construction with shields (minimum 36 ga), bands, clamps, and screws. Couplings shall conform to CISPI 310-2012 for 60 lbf·in torque and a maximum pressure test 6.0 psig.
      b. Hubless Couplings shall conform to CISPI Standard 310 and be certified by NSF® International. Heavy Duty couplings shall conform to ASTM C 1540 and shall be used if indicated. Gaskets shall conform to ASTM C 564. All pipe and fittings to be produced by a single manufacturer and are to be installed in accordance with manufacturer’s recommendations and applicable code requirements.
         1) Manufacturer: Ideal Standard, or Mission No-Hub Coupling.
G. Concealed fixture drain connections from lavatories, water fountains, and counter sinks, and service sinks, and kitchen equipment to cast iron:

H. Fixture drain connections from urinals:
   2. Fittings: drainage pattern DWV cast brass.

I. Indirect drain, 1.25" and larger:
      a. Sump pump piping up to 2".

2.02 SPECIALTY PIPING JOINTS:

A. Unions:
   1. For copper piping 2" and smaller: cast bronze or cast copper with copper soldered or threaded connections.
   2. For piping of dissimilar metals 2" and smaller: provide dielectric unions with solder or threaded connections, nylon insulators, minimum 600 V no flashover, and EPDM gaskets.

B. Flanges:
   1. For piping 2.5" and larger: flange and gasket type. Flanges shall match connection flanges in style, material, and pressure rating.
   2. For piping of dissimilar metals 2.5" and larger: provide dielectric flanges with solder or threaded pipe connections, EPDM gaskets. Flanges shall match connection flanges in style, material, and pressure rating.

2.03 P-TRAPS:

A. For floor drains, and floor sinks: provide with trap primer connection in tail piece if not provided on drain body.

B. Exposed: provide with cleanout plugs.

C. For plumbing fixtures: as specified in Section 22 42 00, Plumbing Fixtures.

2.04 CLEANOUTS:

A. Cleanout surface weight limit is covered under ASME A112.36.2M-1991 (R2012). The medium duty limit is 2000 psi to 4999 psi; the heavy duty limit is 5000 psi to 7499 psi; and the extra heavy duty limit is 7500 psi to 10000 psi.

B. The following floor cleanouts are all heavy duty. If another duty is needed, edit as required.

C. General:
   1. Provide cleanout outlets as follows:
      a. Floors on grade: push-on or inside caulk.

D. Exterior piping: cast iron tapered screw ferrule, and heavy brass or bronze cleanout plug with countersunk head.
   1. Manufacturer: Josam 58900, Smith 4400C-BP, Wade 8550E+8480R, or Zurn Z-1440-BP.

E. Finished area floors: for piping 2" thru 6", cast iron with internal cleanout plug, adjustable housing, and round polished nickel-bronze polished bronze top with securing screws. For cleanouts in floors above grade, provide with flashing clamp.
   1. Manufacturer: Josam 55000-I, Smith 4025, Wade 6000IC, or Zurn ZN-1400-ZN-IC.
2.05 DRAINS:
   A. General:
      1. Outlets shall be same size as the drainage pipe.
      2. Drains shall be from the same manufacturer, unless otherwise indicated.
      3. Provide drain outlets as follows:
         a. Drains in floors on grade: push-on, or inside caulk.
   B. Finished Area Drains:
      1. Light duty general toilet room drain. Available in outlet sizes 2", 3", 4", 5", and 6".
      2. FD-1: cast iron body, trimmed with adjustable 6" 8" round square nickel-bronze hinged
         grate with vandal resistant screws, sediment bucket, trap primer connection, and
         reversible flashing collar.
         a. Manufacturer: Josam 30000X-A, Smith 2010A, Wade 1100 STD, or Zurn ZN415-B.
   C. Mechanical Room Drains:
      1. FD-2: cast iron body, trimmed with recessed grate and 1" anti-splash rim, 7" round cast
         iron rough bronze nickel bronze grate, trap primer connection, and flashing clamp.
         a. Manufacturer: Josam 30000X-7E1, Smith 2010-F37, Wade 1100 ER7-CI, or Zurn
            Z415-7I.

2.06 GREASE INTERCEPTORS:
   A. Outside Grease Interceptors:
      1. Reinforced, precast concrete type designed for AASHTO H-20 loading, complete with
         baffles and access manhole covers with extensions to grade.
      2. Manufacturer: DeKalb Concrete Products, or Old Castle Precast.

2.07 ACCESSORIES:
   A. Bolts and nuts: ASTM A307-2014, Grade B.

PART 3: EXECUTION
3.01 PIPING INSTALLATION:
   A. General:
      1. Piping shall be cut to measurements established at the site and worked into place without
         springing or forcing.
      2. Make changes in the horizontal direction of gravity drainage piping with drainage pattern
         fittings.
      3. Use concentric reducing fittings between different size pipe.
      4. Ream steel, and copper pipe after cutting, turn on end and knock loose dirt, scale, and
         filings from interior of pipe.
      5. Install horizontal drainage piping 3" and smaller with a slope of 0.25" per foot, and piping 4"
         and larger with a slope of 0.125" per foot unless otherwise noted on the Drawings.
      6. Pitch/grade: piping shall be installed with sufficient pitch to ensure drainage and venting.
      7. Install sway bracing and anchorage for piping as required by International Plumbing
   B. Underground Piping:
      1. Install drainage piping outside the building in trenches separate from water piping.
      2. Excavation and backfill: as specified in Section 22 00 10, Plumbing General.
      3. Underground piping shall be connected to the exterior service lines, or capped or plugged
         if the exterior service is not in place.
      4. Piping installed below the level of footings shall be installed 12" horizontally from the
         footing for each 12" of depth below the footing.
   C. Piping Joints:
      1. Solder joint connections shall be cut, deburred, cleaned and assembled in accordance with
         ASTM B828-2016.
2. Threaded connections: screw-thread joints shall be made with cut tapered threads. Joints shall be made tight with Teflon tape. Not more than 2 threads shall show after the joint is made tight, except no threads shall show in exposed chromium-plated piping.
3. Flanged joints: at connections to equipment, flanged joints shall be made with ring type gaskets, extending to inside of bolt holes. Flanged connections to equipment shall be made with full-face gaskets to match flanges on equipment.
4. Mechanical couplings on drainage piping: during the torque process, if any one band of the coupling breaks, replace the entire coupling.
5. Isolate joints between dissimilar metals and connections to tanks with dielectric fittings.
6. Provide adapters where copper or steel pipes connect to cast iron pipe.
7. Provide adapters where cast iron pipe connects to plastic, ductile iron, concrete, or clay pipe, or where field cuts are made in vitrified earthenware or concrete piping. Adapters shall be sized to fit into the bell of pipes with hubs, or over the barrel of pipes without hubs.

D. Coordination:
1. Pipes shall be installed to permit free expansion and contraction without damage to joints, hangers, or the building. Arrange piping to minimize stresses caused by expansion and contraction.
2. Install piping so as to preserve access to valves and equipment and to provide the maximum headroom possible.
3. Provide offsets as required to maintain ceiling height and to coordinate with other trades.
4. Install exposed piping such that when insulation is applied it will not come in contact with adjacent surfaces.
5. Provide flanges or unions at connections to valves and apparatus.
6. Piping to fixtures and equipment shall be braced so that there is no horizontal or vertical movement in the piping.
7. Pipe supports shall be isolated from copper tubing with rubber sleeves.
8. Install food service piping above slab-on-grade in a manner to allow for rapid changes in temperature.
9. Where piping is running parallel to bar joint construction, and there is more than one pipe to be attached to bottom cord of joint, provide supplement steel supports spaced at the minimum hanger spacing, and tac-welded to joint.

3.02 PIPING, FITTINGS, AND JOINTS:
A. Hub and Spigot Cast Iron Pipe and Fittings:
   1. Do not use tee fittings in horizontal drainage piping.
   2. Install with hubs upstream.
   3. Extend vent piping 12" above the roof.
   4. Joints and fittings may be made with compression type gaskets or caulked with white oakum and not less than 12 oz of pure lead for every in of pipe diameter.

3.03 SPECIALTY PIPING JOINTS:
3.04 P-TRAPS:
A. Set traps true and level.
B. Provide in rainwater piping connecting to combination sewers.
C. Install elastomeric trap seals in accordance with manufacturer's instructions.

3.05 CLEANOUTS:
A. General:
   1. Locate cleanouts so that they are accessible and in compliance with codes.
   2. Install floor cleanouts flush and level with the finished floor.
B. Provide cleanouts in drainage piping as indicated on the Drawings, and as follows:
   1. At the bottom of each exposed fixture trap which is not integral with the fixture.
   2. At the beginning of each branch drainage line.
   3. At each change of a horizontal direction greater than 45°.
4. In horizontal drain lines at intervals of not more than 50' for inside piping and 100' for outside piping.

C. Cleanouts outside the building shall extend up to grade and be set flush with finished grade in a 18" x 18" x 8" thick concrete pad.

D. Cleanouts for horizontal piping above grade located above the ceiling shall extend through the floor above, and shall be set flush with that finished floor.

E. Sanitary cleanouts shall not be installed in return air plenums.

F. Cleanouts that occur in carpeted floors shall be installed flush with the floor slab and marked with a stainless steel carpet marker.

3.06 DRAINS:

A. General:
1. Cover the grate of each drain during construction to prevent entry of foreign matter. The covering shall not deface the grate's finish.
2. Remove and clean drain grate, set-screws, insides of drain bodies, and sediment buckets before substantial completion date of the Architect's final certificate.
3. Drains shall not be field modified, except grates may be modified where required for above floor indirect drainage piping.
4. Where waterproof liners are used in the building construction, secure the liners to drain bodies with clamping rings, making watertight connections.
5. Provide trap seal protection for each drain, except shower drains and equipment/fixture drains.

B. Floor Drains/Floor Sinks:
1. Set top of floor drains and floor sinks flush and level with the finished floor, unless noted otherwise on the Drawings.
2. Install drains with recessed grates and anti-splash rims, with the rims flush with the finished floor.
3. Omit grates of drains receiving piped discharge from mechanical equipment so pipes can turn down into basket, unless provided otherwise.
4. Where trap primer connections are made to drain tailpieces, cap or eliminate the trap primer connection on the drain body.
5. Set square drainage grates with sides parallel to the adjacent walls.
6. Where drains are installed in a sloping floor, install at low point.

3.07 GREASE INTERCEPTORS:

A. Outside:
1. Install units as indicated on the Drawings and in accordance with municipality requirements.
2. For below grade installations provide units with concrete over pad and hold down pad as sized by the manufacturer.

3.08 ROOF PENETRATIONS:

A. Select from the following 4 vent options.

B. Vents Through Roofs:
1. Sloping shingle roofs: install with a neoprene gasket sleeve having a base extension for flashing under upper and side shingles and overlapping lower shingles.
2. Sloping shingle roofs: install with roof jack, then flash and counter-flash with 4 psf sheet lead, not less than 18" round/square.
   a. The following is for piping (not vents) and uses the stack sleeve specified under 2.14 Accessories.

3.09 PIPING AND JOINTS TESTS:

A. Piping and piping joints shall be leak free.
B. Test soil, waste, and vent, and rainwater, and food service waste and vent systems piping and joints by capping or plugging all openings, and filling each system with a 10’ head of water, then allowing to stand filled for 1 hour without any leak down. Where a system is tested in sections, each section shall be subjected to the same test.

C. General:
   1. Test piping and joints under floor slabs before slabs are poured.
   2. Tests shall be made while piping and joints are exposed to view.
   3. Submit a statement certifying that piping and joints are tight and have passed the specified test.

D. Leakage Requirements:
   1. Screwed and flanged joints that leak shall be taken apart and reassembled.
   2. Soldered joints that leak shall be cut-out and replaced.
   3. Cast iron hub and spigot joints that leak shall be taken apart and reassembled with new joining materials.
   4. Cast iron no-hub joints that leak shall be taken apart and reassembled with new couplings.

E. Flow Test:
   1. Ensure a smooth and nonobstructed flow of liquid for every drainage pipe, free from construction or natural sediment debris that may have entered during construction.
   2. Route clean and flush with clear water piping having an obstruction.

END OF SECTION
SECTION 22 4400
WATER SYSTEMS

PART 1: GENERAL
1.01 DESCRIPTION:
A. General provisions and other plumbing systems are specified in other Sections of Division 22.
B. Refer to Section 22 00 10, Plumbing General, for a list of plumbing sections included in this specification.
C. This Section covers plumbing water systems.

1.02 QUALITY ASSURANCE:
A. Conform to the following:

PART 2: PRODUCTS
2.01 PIPING, FITTINGS, AND JOINTS:
A. General:
   1. Piping and fitting sizes listed are nominal inside diameter.
B. Cold water, hot water, and hot water circulating, underground, 2.5” and larger:
C. Cold water, hot water, hot water circulating, trap primer, and relief valve discharge, and chilled drinking water, tempered water, tempered water circulating, above grade, 0.5” to 2.5”, except chromium-plated piping at fixtures:
   2. Fittings: wrought copper and/or cast bronze socket fittings, 0.5” to 2.5”, ASME B16.22-2013.
   3. Joints:
      a. Soldered with 95/5 tin/silver or tin/antimony alloy type, with a compatible flux designed to be cold water flushable in potable water systems, ASTM B813-2016 and NSF 61-2016.
      b. Brazed with brazing filler metal, BcuP-3, silver-phosphorous, AWS A5.8/A5.8M-2011.
      c. Mechanically formed fittings may be used at the Contractor's option, where the extraction and brazing processes are performed at floor or bench level.
    1) Manufacturer: T-Drill.

2.02 SPECIALTY PIPING JOINTS:
A. Unions:
   1. For copper piping 2” and smaller: cast bronze with copper soldered connections.
   2. For piping of dissimilar metals 2” and smaller: provide dielectric unions with solder or threaded connections, nylon insulators, and minimum 600 V no flashover.
B. Flanges:
   1. For copper piping 2.5” and larger: class 150, 300, cast bronze companion flange NSF 61-2016 lead free, with solder cup, and flat flange face. Provide a 0.125” thick EPDM NSF/ANSI 61 type rubber gasket.
   2. For piping of dissimilar metals 2.5” and larger: provide dielectric flanges with solder or threaded pipe connections. Provide a 0.125” thick EPDM NSF/ANSI 61 type rubber gasket.
   3. Flanges for equipment connections shall match the equipment's flange in style, material, and pressure rating. Provide a 0.125” thick EPDM NSF/ANSI 61 type rubber gasket.
C. Ball Joints:
   1. Flexible ball joints less than 2.5" diameter shall be manufactured with ductile iron casings and balls. Ball joints shall permit 360° rotation and 28° minimum total angular flex.
   2. Flexible ball joints with a diameter of 2.5" and larger shall be manufactured with carbon steel casings, retainers, and balls. Retainers shall be bolted to allow correct seal adjustment and disassembly for maintenance. Balls shall be protected with crack-free chromium plating. Ball joints shall permit 360° rotation and 15° minimum total angular flex.
   3. Seals shall consist of inner and outer precision molded rings designed for system fluid, temperature, and pressure, without the use of additional packings or sealants. Seals shall be factory-seated with 50 psig saturated steam or equivalent thermal conditions.
   4. Ball joints shall be FM approved or UL listed.
   5. Manufacturer: Hyspan-Barco.

2.03 VALVES:
A. General:
   1. Valves shall be of the same manufacturer, except where a specific product is not available.
   2. Stem packing: asbestos-free.
B. Gate Valves:
   1. Gate valves 2.5" and smaller: class 125, bronze or bronze alloy body with rising stem, threaded bonnet, solid wedge disc, 200 psig wog.
      a. Manufacturer (solder ends): Apollo 101S-LF, Hammond UP635, Milwaukee UP149, or NIBCO S-111-LF.
   2. Gate valves 2" and larger: class 300, bronze body with rising stem, threaded bonnet, solid wedge disc, threaded ends, 600 psig wog.
      a. Manufacturer: Apollo 116T, Hammond IB IB654, Milwaukee 1182, or NIBCO T-174-SS.
C. Ball Valves:
   1. For copper piping, 2" and smaller: 2-piece bronze or bronze alloy body, full port, with blowout-proof stem, rated for 600 psig wog. Valves shall have a stainless steel vented ball, reinforced seat, stuffing box ring, memory stop, and lever handle. Valves in insulated piping shall have 1.25" extended stems.
      a. Manufacturer (soldered ends): Apollo 77CLF-240, Hammond UP8313A, Milwaukee UPBA450S, or NIBCO S-413-Y-LF.
      b. Manufacturer (threaded ends): Apollo 77CLF-140, Hammond UP8303A, Milwaukee UPBA400S, or NIBCO T-413-Y-LF.
D. Check Valves:
   1. Check valves 2.5" and smaller: class 125, bronze body, Y-pattern horizontal swing with renewable bronze disc and seat, screw cap, 200 psig non-shock cwp.
      a. Manufacturer (solder ends): Apollo 161S-LF, Milwaukee UP1509, or NIBCO S-413-Y-LF.
      b. Manufacturer (threaded ends): Apollo 161T-LF, Milwaukee UP509, or NIBCO T-413-Y-LF.

2.04 STRAINERS:
A. Strainers 2.5" and smaller: class 125, bronze body, Y-pattern, with a 20 mesh type 304 stainless steel screen, threaded cap, 200 psig non-shock cwp.
   1. Manufacturer (solder ends): Apollo 59LF-300, or Wilkins YBXLC.
   2. Manufacturer (threaded ends): Apollo 59LF-000, or Wilkins YBXL.

2.05 HOSE BIBS:
A. For mechanical or equipment spaces: chromium-plated brass with 0.75" inlet, tee handle, built-in atmospheric vacuum breaker, and 0.75" hose thread outlet.
   1. Manufacturer: Chicago 952 XKCP, T&S B-0722-RGH, or Zurn Z875L7.
B. For finished areas: polished chromium-plated brass with 0.75" inlet, tee handle, built-in atmospheric vacuum breaker, and 0.75" hose thread outlet.
   1. Manufacturer: Chicago 952XX, T&S B-0722, or Zurn Z875L7.

2.06 HYDRANTS:
A. Wall Hydrants:
   1. Non-freeze type with bronze body and casing, 0.75" threaded inlet, 0.75" hose thread outlet, integral vacuum breaker, key handle, adjustable wall clamp, recessed box with hinged locking cover with the word WATER cast in, surface-mounted, and nickel rough polished bronze finish.
      a. Manufacturer: Josam 71000, Smith 5509 QT, Wade 8600-175, or Zurn Z-1300.

2.07 PRESSURE REDUCING VALVES:
A. PRV- : direct operating type with high capacity, bronze body, stainless steel spring, sealed spring chamber, stainless steel seat ring, composition disc, built-in bypass, and threaded ends. Provide unit with isolation valves, pressure gauges, and separate wye pattern strainer.
   1. Manufacturer: Apollo PRLF, or Wilkins 500XL.

2.08 BACKFLOW PREVENTERS:
A. BFP-1 : reduced pressure type for cold water 0.75" to 2": with bronze body, stainless steel working parts, check modules, test cocks, relief module, and threaded ends. Provide the assembly with isolation valves, air gap drain device, and separate wye pattern strainer.
   1. Manufacturer: Apollo RP4ALF, or Wilkins 975XL.

2.09 TRAP PRIMERS:
A. Brass construction, capacity to prime traps as indicated on the Drawings, line pressure operation, with distribution units with copper body where indicated on the Drawings.
   1. Manufacturer:
      a. Trap primer for flush valve lines: Precision Plumbing Produces, Prime-Rite.
      b. Trap primer for faucet lines: Precision Plumbing Products, Oregon 1 PO-500.
      c. Distribution unit: Precision Plumbing Products, DU-4.
   B. Automatic mini trap primers: electronic trap primer with distribution unit, 1" air gap, preset 24 hour timer set for 10 second minimum operation every 24 hours, manual override switch, fuse, 120 V solenoid valve, 0.5" inlet connection, and 0.375" outlet compression fittings.
      1. Manufacturer: Precision Plumbing Products Mini-Prime, or Zurn Z-1020-ETP.

2.10 WATER HAMMER ARRESTERS:
A. Enclosed piston type with copper tubing enclosure, FDA approved double O-ring seals, threaded connections, ASSE 1010-2004 certified.
   1. Manufacturer: Precision Plumbing Products SC series, Sioux Chief 650 series, Smith 5200 series, Watts LF15M2 series, or Wilkins 1250XL.

2.11 PRESSURE GAUGES:
A. Bourdon tube type with stainless steel tube and socket, stainless steel movements with 0.5% accuracy over the full scale, and 150°F minimum operating temperature.
B. The wetted parts shall be housed in a flangeless metal case with a clear safety glass lens, stainless steel front ring, and stainless steel 0.25" NPT lower connection. Provide each gauge with a stainless steel pressure snubber and needle valve 250 400 psig for piping connections.
C. The dial face shall be white painted aluminum 4.5" in diameter with black graduations and letterings. The units of measure shall be in psig. The pointer shall be black painted aluminum and adjustable.
D. Gauges shall be selected where the average pressure is at the scale's midpoint, and incorporating the following as applicable:

<table>
<thead>
<tr>
<th>Location</th>
<th>Scale Range</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bidding Documents - October 31st 2018</td>
<td>22 4400 - 3 WATER SYSTEMS</td>
</tr>
</tbody>
</table>
2.12 WATER HEATERS:
A. WH-1: electric water heater, UL listed packaged unit with low profile vertical storage tank, heating elements, ASME and CSA pressure and temperature relief valve, controls with enclosure, and meeting the mandatory provisions of ASHRAE/IES 90.1-2016 and ANSI Z21.10.3-2015/CSA 4.3-2015.
   1. Controls: immersion thermostats, temperature adjustment control, high temperature shut-off, low water shut-off, and low watt density immersion heating elements, with single-element dual-element non-simultaneous operation dual-element simultaneous operation configuration.
   2. Wall mounting kit.
   3. Warranty: the complete water heater assembly shall be provided with a nonprorated warranty, in writing, by the manufacturer for a period of 1 year from heater start-up. The warranty shall include defects in the design and construction of the assembly, including parts and components. The warranty shall cover all costs including parts, heaters, shipping, and labor, with no cost being incurred by the Owner. If repairs are unable to be performed, the water heater shall be replaced with an equal unit.
B. WH-2: commercial electric water heater, UL listed packaged unit with vertical storage tank, heating elements, ASME and CSA pressure and temperature relief valve, controls with enclosure, and meeting the mandatory provisions of ASHRAE/IES 90.1-2016 and ANSI Z21.10.3-2015/CSA 4.3-2015.
   1. Controls: upper and lower immersion thermostats, temperature adjustment control, high temperature shut-off, low water shut-off, and low watt density immersion heating elements with dual-element non-simultaneous operation dual-element simultaneous operation time sequencer configuration.
   2. Tanks: cement- or glass-lined carbon steel, 125 150 psig working pressure, polypropylene or cross-link polymer dip tube, polysulfone dip tube, and drain valve. For tanks with porous linings provide a magnesium anode rod.
   3. Enclosures: minimum K value of 2.17 Btu·in/(h·ft²·°F) at 80°F for tank insulation, and steel jacket with baked enamel finish.
   4. Warranty: the complete water heater assembly shall be provided with a nonprorated warranty, in writing, by the manufacturer for a period of 1 year from heater start-up. The warranty shall include defects in the design and construction of the assembly, including parts and components. Additionally there shall be a nonprorated 3 year warranty against tank failure due to rust, and an operational warranty for odor and discolored water due to tank rust or tank lining. The warranty shall cover all costs including parts, heaters, shipping, and labor, with no cost being incurred by the Owner. If repairs are unable to be performed, the water heater shall be replaced with an equal unit.

2.13 MIXING VALVES:
A. Multiple fixture mixing valves MV-1: thermostatic type mixing valve with bronze or brass body, chromium-plated finish, lockable temperature setting, inlets with integral check valves, 0.5 gpm minimum flow, and conforming to ASSE 1070-2015.
B. Building master mixing valves MV-2: high/low mixing valve assembly with bronze body, self-contained, thermostatically controlled mixing valves with adjustable setpoints, check-stop inlets, union inlet and outlet connections, dial thermometer on discharge and copper piping.
High/low assemblies shall have a minimum flow rate of 0.5 gpm and include 2 mixing valves in parallel and an intermediate pressure reducing valve with pressure gauges. Assembly shall be factory assembled and tested in accordance with ASSE 1017-2009. Provide a satin spray finish to the completed assembly.

1. Manufacturer: Leonard TMLF Hi/Low series, Powers LFMM430 Hi/Low series, or Symmons 7 Hi/Low series.

2.14 FILTERS:

A. These filters are for domestic cold water for food service and are not rated for hot water.

B. Ice Makers and Water Dispenser Filters:
   1. A changeable cold water filter system with minimum of 2 in-line filters, pressure gauges, 0.75” inlet and outlet connections, and wall mounting bracket with manifold. The system shall meet NSF and FDA requirements for safe drinking water.
   2. Filter systems shall be able to remove sediment 0.5 micron in size and larger, and reduce chloramine, chlorine, and cysts. Filters shall have a built-in inhibitor to reduce lime scale build-up.
   3. Filter systems shall have a minimum capacity of 70,000 gal volume usage with a flow rate of 5.0 gpm and a working pressure of 100 psig.
   4. Manufacturer: Bunn EQHP-TWIN 70L, Everpure CB20-302E, or 3M ICE260-S.

PART 3: EXECUTION

3.01 GENERAL PIPING INSTALLATION:

A. General:
   1. Install all piping, fittings, and joints in accordance with the applicable manufacturer’s instructions whether underground or aboveground.
   2. Piping shall be cut to measurements established at the site and worked into place without springing or forcing.
   3. Use concentric reducing fittings between different size pipes.
   4. Ream steel, brass and copper pipe after cutting, turn on end and knock loose dirt, scale, and filings from interior of pipe.
   5. Slope water piping to drain back to the mains.
   6. Provide plastic pipe manufacturer’s recommended expansion and contraction loops.
   7. Install piping that is to receive insulation in a manner that when the insulation is installed, the finished wall of the insulation is not crushed nor in contact with any adjacent surface or equipment.

B. Underground:
   1. Install water piping outside the building in trenches separate from sewers.
   2. Excavation and backfill: as specified in Section 22 00 10, Plumbing General.
   3. Underground piping shall be connected to the exterior service line, or capped or plugged if the exterior service is not in place.
   4. Block ductile iron water pipe with concrete poured in contact with undisturbed earth. Provide tie rods for outside joints.
   5. Piping installed below a footing’s bottom elevation shall be installed a minimum of 12” horizontally from the footing for each 12” of depth below the footing.

C. Aboveground:
   1. Piping shall be installed to permit free expansion and contraction, as controlled by pipe anchors, without damage to joints, hangers, or the building. Arrange piping to minimize stresses caused by expansion and contraction.
   2. Group exposed pipe together and arrange control valves at fixtures for ease of operation.
   3. Install piping so as to preserve access to valves and equipment and to provide the maximum headroom possible.
   4. Provide offsets to maintain ceiling height and to coordinate with other trades.
   5. Install exposed piping such that when insulation is applied it will not come in contact with adjacent surfaces.
D. Piping Joints:
   1. General:
      a. Isolate joints between dissimilar metals and connections to tanks with dielectric fittings.
      b. Provide flanges, grooved couplings, or unions at connections to equipment.
      c. Install mechanically grooved couplings and press fittings in accordance with the manufacturer's instructions, and provide factory trained personnel for installation.
   2. Solder joints: pipe ends shall be cut square, deburred, cleaned and assembled in accordance with ASTM B828-2016.
   3. Threaded joints: screw-thread joints shall be made with cut tapered threads. Joints shall be made tight with Teflon tape. Not more than 2 threads shall show after the joint is made tight, except no threads shall show in exposed chromium-plated piping.
   4. Flanged joints: except at connections to equipment, flanged joints shall be made with ring type gaskets, extending to inside of bolt holes.
   5. Mechanically formed tee joints: joints shall be brazed in accordance with the Copper Development Association Copper Tube Handbook using BCuP series filler metal. Mechanics performing mechanically extracted fitting operations shall be certified by the manufacturer.

3.02 PIPING, FITTINGS AND JOINTS:

A. General:

B. Copper Tubing:
   1. Noninsulated piping installed in masonry construction shall be painted 2 coats of asphaltum paint.
   2. Clean, prime, and paint exposed noninsulated piping with 2 coats of glossy silver paint.

3.03 SPECIALTY PIPING JOINTS:

A. Unions:
   1. Provide in each piping connection to each piece of equipment where equipment may be removed.
   2. Unions are not required where flanges or roll-grooved mechanical joint couplings are provided.

B. Flange Joints:
   1. Provide in piping connections to equipment where flanges are provided.

C. Ball Joints:
   1. Ball joints shall be installed in accordance with manufacturer's recommendations.
   2. Where ball joints are used across building seismic joints, they shall be installed in accordance with manufacturer's recommendations and SMACNA Seismic Restraint Manual: Guidelines for Mechanical Systems-2008.

3.04 VALVES:

A. General:
   1. Provide an isolation valve in the cold water service line near the point of entrance into the building. On the building side and near the gate valve, install a drain leg with 0.75" hose bib.
   2. Provide a valve in each water supply connection to hose bibs, wall hydrants and water using equipment.
   3. Install valves in clear locations so that handles and hand wheels are easily accessible for completely opening and closing of the valves.

3.05 HYDRANTS:

A. General:
   1. Provide Owner with a loose key for each hydrant and obtain a receipt listing quantity and type of hydrant keys.

B. Wall Hydrants:
1. Install 18" above finished grade, except where building conditions and/or grade prevents the installation. Modify installation height as required, up to 36" above finished grade, where 18" will not work.

3.06 BACKFLOW PREVENTERS:
   A. Ensure that the floor drain has been sized per the manufacturer's recommendations.
   B. Drain line from each unit shall be DWV copper run full size to floor drain, as indicated on the Drawings.

3.07 TRAP PRIMERS:
   A. Connect trap primer lines to the drain tailpieces where field conditions prohibit connection to the trap primer connections on the drain bodies.
   B. Install trap primers with a straight downward slope to allow drainage from the trap primer valve.

3.08 WATER HAMMER ARRESTERS:
   A. Install water hammer arresters in accordance with PDI WH 201-2010.

3.09 PRESSURE GAUGES:
   A. Provide water filled gauges at the water pressure booster system, and at

3.10 WATER HEATERS:
   A. Install heaters level and stable.
   1. Water heaters 120 gal and smaller do not normally require a factory start-up. Use with water heaters 130 gal and larger, and smaller systems like condensing, boiler and storage tank, and heat pump water heaters.

3.11 THERMAL EXPANSION TANKS:
   A. Support tanks with hangers independently from adjacent piping or on the floor where floor bases are provided.

3.12 MIXING VALVES:
   A. Connect mixing valves to the piping systems per the manufacturer's published installation recommendations.
   B. Secure each mixing valve assembly to a backboard mounted on the wall.
   1. Sensing bulbs are used only with industrial, high capacity valves.
   C. Install each sensing bulb in a minimum 1" tee so that the bulb is completely washed by the flow.

3.13 ROOF PENETRATIONS:
   A. Where pipes pass through the roof, flash with a sheet of 4 psf lead flashing extending at least 8" from the clamping ring in all directions.

3.14 PIPING AND JOINT PRESSURE TESTING:
   A. General:
   1. Test piping and joints under floor slabs before slabs are poured.
   2. Tests shall be made while piping and joints are exposed to view.
   3. Screwed, flanged, and grooved joints that leak shall be taken apart and reassembled.
   4. Soldered, brazed, and clamped joints that leak shall be cut out and replaced.
   5. Submit a statement certifying that piping and joints are tight and have passed the specified test.
   B. Piping Systems:
   1. Test cold water, hot water, and hot water circulating systems, and tempered water systems, and chilled water systems piping and joints by capping all openings and applying a hydrostatic pressure of 125 psig for 1 hour without any drop in pressure. Disconnect the pump source prior to and during testing. Where a system is tested in sections, each section shall be subjected to the same test.
2. Test cold water, hot water, and hot water circulating systems, and tempered water systems, and chilled water systems plastic piping and joints by capping all openings and applying a hydrostatic pressure of 170 psig for 2 hours without any drop in pressure. Disconnect the pump source prior to and during testing. Where a system is tested in sections, each section shall be subjected to the same test.

3.15 PIPING SYSTEM TEMPERATURE TESTING:

3.16 HOT WATER SYSTEMS:

A. Flow the hot water systems then allow the systems to stand for one hour before beginning testing.

B. Perform hot water temperature checks at each fixture, and verify that the correct water temperature, as indicated on the Drawings, is flowing from each hot water outlet.

C. Where any fixture's hot water temperature is incorrect, make adjustments as required to the water heaters, mixing valves, balancing assemblies, and circulation pumps, and temperature maintenance cable.

D. Documentation:
   1. Provide a document for the Operation and Maintenance Manual that dates, locates, and records the flow settings at each balancing station, and the temperatures recorded at each fixture.

3.17 CLEANING AND DISINFECTION:

A. Check local codes for more stringent disinfection requirements.

B. Domestic Water Piping:
   1. Clean and disinfect inside water piping prior to placing the system in operation.
   2. Purge domestic cold water, and hot water and hot water circulating and tempered water, and chilled drinking water supply and circulating piping, including heaters, pumps, tanks, and fixtures.
   3. Flush the piping systems with potable water from the municipal supply system until water runs clear.
      a. Select one of the following water/chlorine treatment solutions.
   4. Fill the system with clean water with a water/chlorine solution containing a minimum 50 ppm chlorine. Isolate the piping systems and allow to stand for 24 hours.
   5. Fill the system with a water/chlorine solution containing a minimum 200 ppm chlorine. Isolate the piping systems and allow to stand for 3 hours.
   6. Flush the systems with clean, potable water from the municipal supply system until the chlorine in the system is the same level as the municipal supply system.
   7. Submit water samples for biological examination by laboratories approved by the local health authority. Samples shall be taken in the presence of the Owner. Using Agency.
   8. Repeat the procedures and resubmit water samples as required to pass the biological test. Minimum acceptance test results shall be 0.0 colonies of coliform bacteria.
   9. Provide results of tests.
   10. Materials and test methods shall comply with AWWA C651-2014.

C. Strainers: after final flushing of the water system, remove strainer baskets for cleaning and disinfection. Reinstall baskets and ensure that caps are leak tight.

END OF SECTION
SECTION 23 0513
COMMON MOTOR REQUIREMENTS FOR HVAC EQUIPMENT

PART 1 GENERAL
1.01 SECTION INCLUDES
A. General construction and requirements.
B. Applications.
C. Single phase electric motors.
D. Three phase electric motors.
E. Electronically Commutated Motors (ECM).

1.02 RELATED REQUIREMENTS
A. Section 26 0583 - Wiring Connections: Electrical characteristics and wiring connections.
B. Section 26 2913 - Enclosed Controllers.

1.03 REFERENCE STANDARDS
A. ABMA STD 9 - Load Ratings and Fatigue Life for Ball Bearings; 2015.
C. NEMA MG 1 - Motors and Generators; 2017.
D. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

1.04 SUBMITTALS
A. See Section 01 3000 - Administrative Requirements for submittal procedures.
B. Product Data: Provide wiring diagrams with electrical characteristics and connection requirements.
C. Test Reports: Indicate test results verifying nominal efficiency and power factor for three phase motors larger than 1/2 horsepower.
D. Manufacturer’s Installation Instructions: Indicate setting, mechanical connections, lubrication, and wiring instructions.
E. Operation Data: Include instructions for safe operating procedures.
F. Maintenance Data: Include assembly drawings, bearing data including replacement sizes, and lubrication instructions.

1.05 QUALITY ASSURANCE
A. Conform to NFPA 70.
B. Provide certificate of compliance from Authority Having Jurisdiction indicating approval of high efficiency motors.

1.06 WARRANTY
A. See Section 01 7800 - Closeout Submittals for additional warranty requirements.
B. Provide five year manufacturer warranty for motors larger than 20 horsepower.

PART 2 PRODUCTS
2.01 MANUFACTURERS
C. Regal-Beloit Corporation (Century); _____: www.centuryelectricmotor.com/#sle.
D. Substitutions: See Section 01 6000 - Product Requirements.
2.02 GENERAL CONSTRUCTION AND REQUIREMENTS

A. Electrical Service: Refer to Section 26 0583 for required electrical characteristics.

B. Construction:
   1. Open drip-proof type except where specifically noted otherwise.
   2. Design for continuous operation in 104 degrees F (40 degrees C) environment.
   3. Design for temperature rise in accordance with NEMA MG 1 limits for insulation class, service factor, and motor enclosure type.

C. Visible Nameplate: Indicating motor horsepower, voltage, phase, cycles, RPM, full load amps, locked rotor amps, frame size, manufacturer's name and model number, service factor, power factor, efficiency.

D. Wiring Terminations:
   1. Provide terminal lugs to match branch circuit conductor quantities, sizes, and materials indicated. Enclose terminal lugs in terminal box sized to NFPA 70, threaded for conduit.
   2. For fractional horsepower motors where connection is made directly, provide threaded conduit connection in end frame.

2.03 APPLICATIONS

A. Exception: Motors less than 250 watts, for intermittent service may be the equipment manufacturer's standard and need not conform to these specifications.

B. Single phase motors for shaft mounted fans, oil burners, and centrifugal pumps: Split phase type.

C. Single phase motors for shaft mounted fans or blowers: Permanent split capacitor type.

D. Single phase motors for fans, pumps, blowers, and air compressors: Capacitor start type.

E. Single phase motors for fans, blowers, and pumps: Capacitor start, capacitor run type.

F. Motors located in exterior locations, wet air streams downstream of sprayed coil dehumidifiers, draw through cooling towers, air cooled condensers, humidifiers, direct drive axial fans, roll filters, explosion proof environments, and dust collection systems: Totally enclosed type.

G. Motors located in outdoors, in wet air streams downstream of sprayed coil dehumidifiers, in draw through cooling towers, and in humidifiers: Totally enclosed weatherproof epoxy-treated type.

H. Motors located outdoors and in draw through cooling towers: Totally enclosed weatherproof epoxy-sealed type.

2.04 SINGLE PHASE POWER - SPLIT PHASE MOTORS

A. Starting Torque: Less than 150 percent of full load torque.

B. Starting Current: Up to seven times full load current.

C. Breakdown Torque: Approximately 200 percent of full load torque.

D. Drip-proof Enclosure: Class A (50 degrees C temperature rise) insulation, NEMA Service Factor, prelubricated sleeve or ball bearings.

E. Enclosed Motors: Class A (50 degrees C temperature rise) insulation, 1.0 Service Factor, prelubricated ball bearings.

2.05 SINGLE PHASE POWER - PERMANENT-SPLIT CAPACITOR MOTORS

A. Starting Torque: Exceeding one fourth of full load torque.

B. Starting Current: Up to six times full load current.

C. Multiple Speed: Through tapped windings.

D. Open Drip-proof or Enclosed Air Over Enclosure: Class A (50 degrees C temperature rise) insulation, minimum 1.0 Service Factor, prelubricated sleeve or ball bearings, automatic reset overload protector.
2.06 SINGLE PHASE POWER - CAPACITOR START MOTORS
A. Starting Torque: Three times full load torque.
B. Starting Current: Less than five times full load current.
C. Pull-up Torque: Up to 350 percent of full load torque.
D. Breakdown Torque: Approximately 250 percent of full load torque.
E. Motors: Capacitor in series with starting winding; provide capacitor-start/capacitor-run motors with two capacitors in parallel with run capacitor remaining in circuit at operating speeds.
F. Drip-proof Enclosure: Class A (50 degrees C temperature rise) insulation, NEMA Service Factor, prelubricated sleeve bearings.
G. Enclosed Motors: Class A (50 degrees C temperature rise) insulation, 1.0 Service Factor, prelubricated ball bearings.

2.07 THREE PHASE POWER - SQUIRREL CAGE MOTORS
A. Starting Torque: Between 1 and 1-1/2 times full load torque.
B. Starting Current: Six times full load current.
C. Power Output, Locked Rotor Torque, Breakdown or Pull Out Torque: NEMA Design B characteristics.
E. Insulation System: NEMA Class B or better.
F. Testing Procedure: In accordance with IEEE 112. Load test motors to determine free from electrical or mechanical defects in compliance with performance data.
G. Motor Frames: NEMA Standard T-Frames of steel, aluminum, or cast iron with end brackets of cast iron or aluminum with steel inserts.
H. Thermistor System (Motor Frame Sizes 254T and Larger): Three PTC thermistors embedded in motor windings and epoxy encapsulated solid state control relay for wiring into motor starter; refer to Section 26 2913.
I. Bearings: Grease lubricated anti-friction ball bearings with housings equipped with plugged provision for relubrication, rated for minimum ABMA STD 9, L-10 life of 20,000 hours. Calculate bearing load with NEMA minimum V-belt pulley with belt center line at end of NEMA standard shaft extension. Stamp bearing sizes on nameplate.
J. Sound Power Levels: To NEMA MG 1.
K. Part Winding Start Where Indicated: Use part of winding to reduce locked rotor starting current to approximately 60 percent of full winding locked rotor current while providing approximately 50 percent of full winding locked rotor torque.
L. Weatherproof Epoxy Sealed Motors: Epoxy seal windings using vacuum and pressure with rotor and starter surfaces protected with epoxy enamel; bearings double shielded with waterproof non-washing grease.
M. Nominal Efficiency: As indicated at full load and rated voltage when tested in accordance with IEEE 112.
N. Nominal Power Factor: As indicated at full load and rated voltage when tested in accordance with IEEE 112.

PART 3 EXECUTION
3.01 INSTALLATION
A. Install in accordance with manufacturer's instructions.
B. Install securely on firm foundation. Mount ball bearing motors with shaft in any position.
C. Check line voltage and phase and ensure agreement with nameplate.

END OF SECTION
SECTION 23 0553
IDENTIFICATION FOR HVAC PIPING AND EQUIPMENT

PART 1   GENERAL

1.01   SECTION INCLUDES

A. Nameplates.
B. Tags.
C. Adhesive-backed duct markers.
D. Stencils.
E. Pipe markers.
F. Ceiling tacks.

1.02   RELATED REQUIREMENTS

A. Section 09 9123 - Interior Painting: Identification painting.

1.03   REFERENCE STANDARDS


1.04   SUBMITTALS

A. See Section 01 3000 - Administrative Requirements for submittal procedures.
B. Chart and Schedule: Submit valve chart and schedule, including valve tag number, location, function, and valve manufacturer's name and model number.
C. Product Data: Provide manufacturers catalog literature for each product required.

PART 2   PRODUCTS

2.01   IDENTIFICATION APPLICATIONS

A. Air Handling Units: Nameplates.
B. Air Terminal Units: Tags.
C. Automatic Controls: Tags. Key to control schematic.
D. Control Panels: Nameplates.
E. Dampers: Ceiling tacks, where located above lay-in ceiling.
F. Ductwork: Nameplates.
H. Instrumentation: Tags.
I. Major Control Components: Nameplates.
J. Piping: Tags.
K. Pumps: Nameplates.
L. Relays: Tags.
M. Small-sized Equipment: Tags.
N. Tanks: Nameplates.
O. Thermostats: Nameplates.
P. Valves: Tags and ceiling tacks where located above lay-in ceiling.
Q. Water Treatment Devices: Nameplates.

2.02   NAMEPLATES

A. Manufacturers:
   1. Advanced Graphic Engraving, LLC; ______: www.advancedgraphicengraving.com/#sle.
5. Substitutions: See Section 01 6000 - Product Requirements.

C. Letter Height: 1/4 inch (6 mm).
D. Background Color: Black.

2.03 TAGS

A. Manufacturers:
1. Advanced Graphic Engraving; ______: www.advancedgraphicengraving.com/#sle.
5. Seton Identification Products, a Tricor Company; ______: www.seton.com/#sle.
6. Substitutions: See Section 01 6000 - Product Requirements.

B. Plastic Tags: Laminated three-layer plastic with engraved black letters on light contrasting background color. Tag size minimum 1-1/2 inch (40 mm) diameter.
C. Metal Tags: Brass with stamped letters; tag size minimum 1-1/2 inch (40 mm) diameter with smooth edges.
D. Valve Tag Chart: Typewritten letter size list in anodized aluminum frame.

2.04 ADHESIVE-BACKED DUCT MARKERS

A. Manufacturers:
2. Substitutions: See Section 01 6000 - Product Requirements.

B. Material: High gloss acrylic adhesive-backed vinyl film 0.0032 inch (0.76 mm); printed with UV and chemical resistant inks.
C. Style: Individual Label.
D. Color: Yellow/Black.

2.05 STENCILS

A. Manufacturers:
4. Substitutions: See Section 01 6000 - Product Requirements.

B. Stencils: With clean cut symbols and letters of following size:

1. 3/4 to 1-1/4 inch (20-30 mm) Outside Diameter of Insulation or Pipe: 8 inch (200 mm) long color field, 1/2 inch (15 mm) high letters.
2. 1-1/2 to 2 inch (40-50 mm) Outside Diameter of Insulation or Pipe: 8 inch (200 mm) long color field, 3/4 inch (20 mm) high letters.
3. 2-1/2 to 6 inch (65-150 mm) Outside Diameter of Insulation or Pipe: 12 inch (300 mm) long color field, 1-1/4 inch (30 mm) high letters.
4. 8 to 10 inch (200-250 mm) Outside Diameter of Insulation or Pipe: 24 inch (600 mm) long color field, 2-1/2 inch (65 mm) high letters.
5. Over 10 inch (250 mm) Outside Diameter of Insulation or Pipe: 32 inch (800 mm) long color field, 3-1/2 inch (90 mm) high letters.
6. Ductwork and Equipment: 2-1/2 inch (65 mm) high letters.

C. Stencil Paint: As specified in Section 09 9123, semi-gloss enamel, colors conforming to ASME A13.1.

2.06 PIPE MARKERS

A. Manufacturers:

Bidding Documents - October 31st 2018 23 0553 - 2 IDENTIFICATION FOR HVAC PIPING AND EQUIPMENT
4. MIFAB, Inc; ______: www.mifab.com/#sle.
5. Seton Identification Products, a Tricor Company; ______: www.seton.com/#sle.
6. Substitutions: See Section 01 6000 - Product Requirements.

B. Color: Conform to ASME A13.1.

C. Plastic Pipe Markers: Factory fabricated, flexible, semi-rigid plastic, preformed to fit around pipe or pipe covering; minimum information indicating flow direction arrow and identification of fluid being conveyed.

D. Plastic Tape Pipe Markers: Flexible, vinyl film tape with pressure sensitive adhesive backing and printed markings.

E. Underground Plastic Pipe Markers: Bright colored continuously printed plastic ribbon tape, minimum 6 inches (150 mm) wide by 4 mil (0.10 mm) thick, manufactured for direct burial service.

F. Color code as follows:
   1. Heating, Cooling, and Boiler Feedwater: Green with white letters.
   2. Toxic and Corrosive Fluids: Orange with black letters.
   3. Compressed Air: Blue with white letters.

2.07 CEILING TACKS

A. Manufacturers:
   2. Substitutions: See Section 01 6000 - Product Requirements.

B. Description: Steel with 3/4 inch (20 mm) diameter color coded head.

C. Color code as follows:
   1. HVAC Equipment: Yellow.
   2. Fire Dampers and Smoke Dampers: Red.

PART 3 EXECUTION

3.01 PREPARATION

A. Degrease and clean surfaces to receive adhesive for identification materials.

3.02 INSTALLATION

A. Install nameplates with corrosive-resistant mechanical fasteners, or adhesive. Apply with sufficient adhesive to ensure permanent adhesion and seal with clear lacquer.

B. Install tags with corrosion resistant chain.

C. Apply stencil painting in accordance with Section 09 9123.

D. Install plastic pipe markers in accordance with manufacturer's instructions.

E. Install plastic tape pipe markers complete around pipe in accordance with manufacturer's instructions.

F. Use tags on piping 3/4 inch (20 mm) diameter and smaller.
   1. Identify service, flow direction, and pressure.
   2. Install in clear view and align with axis of piping.
   3. Locate identification not to exceed 20 feet (6 m) on straight runs including risers and drops, adjacent to each valve and Tee, at each side of penetration of structure or enclosure, and at each obstruction.

G. Install ductwork with plastic nameplates. Identify with air handling unit identification number and area served. Locate identification at air handling unit, at each side of penetration of structure or enclosure, and at each obstruction.
H. Locate ceiling tacks to locate valves or dampers above lay-in panel ceilings. Locate in corner of panel closest to equipment.

END OF SECTION
SECTION 23 0593
TESTING, ADJUSTING, AND BALANCING FOR HVAC

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Testing, adjustment, and balancing of air systems.
B. Measurement of final operating condition of HVAC systems.
C. Sound measurement of equipment operating conditions.
D. Vibration measurement of equipment operating conditions.

1.02 RELATED REQUIREMENTS

A. Section 01 2100 - Allowances: Inspection and testing allowances.
B. Section 01 4000 - Quality Requirements: Employment of testing agency and payment for services.

1.03 PRICE AND PAYMENT PROCEDURES

A. Cash Allowance: See Section 01 2100 for additional requirements.
B. Allowance includes testing, adjusting, and balancing of mechanical systems.

1.04 REFERENCE STANDARDS


1.05 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.
B. Installer Qualifications: Submit name of adjusting and balancing agency and TAB supervisor for approval within 30 days after award of Contract.
C. TAB Plan: Submit a written plan indicating the testing, adjusting, and balancing standard to be followed and the specific approach for each system and component.
   1. Submit to Architect.
   2. Submit six weeks prior to starting the testing, adjusting, and balancing work.
   3. Include certification that the plan developer has reviewed the contract documents, the equipment and systems, and the control system with the Architect and other installers to sufficiently understand the design intent for each system.
   4. Include at least the following in the plan:
      a. Preface: An explanation of the intended use of the control system.
      b. List of all air flow, water flow, sound level, system capacity and efficiency measurements to be performed and a description of specific test procedures, parameters, formulas to be used.
      c. Copy of field checkout sheets and logs to be used, listing each piece of equipment to be tested, adjusted and balanced with the data cells to be gathered for each.
      d. Identification and types of measurement instruments to be used and their most recent calibration date.
      e. Discussion of what notations and markings will be made on the duct and piping drawings during the process.
      f. Final test report forms to be used.
      g. Detailed step-by-step procedures for TAB work for each system and issue, including:
         1) Terminal flow calibration (for each terminal type).
         2) Diffuser proportioning.
3) Branch/submain proportioning.
4) Total flow calculations.
5) Rechecking.
6) Diversity issues.

h. Expected problems and solutions, etc.
i. Criteria for using air flow straighteners or relocating flow stations and sensors.
j. Details of how TOTAL flow will be determined; for example:
   1) Air: Sum of terminal flows via control system calibrated readings or via hood
      readings of all terminals, supply (SA) and return air (RA) pitot traverse, SA or RA
      flow stations.
   2) Water: Pump curves, circuit setter, flow station, ultrasonic, etc.
k. Specific procedures that will ensure that both air and water side are operating at the
   lowest possible pressures and methods to verify this.
l. Confirmation of understanding of the outside air ventilation criteria under all
   conditions.
m. Method of verifying and setting minimum outside air flow rate will be verified and set
   and for what level (total building, zone, etc.).
n. Method of checking building static and exhaust fan and/or relief damper capacity.
o. Proposed selection points for sound measurements and sound measurement
   methods.
p. Methods for making coil or other system plant capacity measurements, if specified.
q. Time schedule for TAB work to be done in phases (by floor, etc.).
r. Description of TAB work for areas to be built out later, if any.
s. Time schedule for deferred or seasonal TAB work, if specified.
t. False loading of systems to complete TAB work, if specified.
u. Exhaust fan balancing and capacity verifications, including any required room
   pressure differentials.
v. Interstitial cavity differential pressure measurements and calculations, if specified.
w. Procedures for field technician logs of discrepancies, deficient or uncompleted work
   by others, contract interpretation requests and lists of completed tests (scope and
   frequency).
x. Procedures for formal progress reports, including scope and frequency.
y. Procedures for formal deficiency reports, including scope, frequency and distribution.

D. Control System Coordination Reports: Communicate in writing to the controls installer all
   setpoint and parameter changes made or problems and discrepancies identified during TAB
   that affect, or could affect, the control system setup and operation.

E. Progress Reports.

F. Final Report: Indicate deficiencies in systems that would prevent proper testing, adjusting, and
   balancing of systems and equipment to achieve specified performance.
   1. Submit under provisions of Section 01 4000.
   2. Revise TAB plan to reflect actual procedures and submit as part of final report.
   3. Submit draft copies of report for review prior to final acceptance of Project. Provide final
      copies for Architect and for inclusion in operating and maintenance manuals.
   4. Provide reports in soft cover, letter size, 3-ring binder manuals, complete with index page
      and indexing tabs, with cover identification at front and side. Include set of reduced
      drawings with air outlets and equipment identified to correspond with data sheets, and
      indicating thermostat locations.
   5. Include actual instrument list, with manufacturer name, serial number, and date of
      calibration.
   6. Form of Test Reports: Where the TAB standard being followed recommends a report
      format use that; otherwise, follow ASHRAE Std 111.
   7. Units of Measure: Report data in I-P (inch-pound) units only.
   8. Include the following on the title page of each report:
      a. Name of Testing, Adjusting, and Balancing Agency.
b. Address of Testing, Adjusting, and Balancing Agency.
c. Telephone number of Testing, Adjusting, and Balancing Agency.
d. Project name.
e. Project location.
f. Project Architect.
g. Project Engineer.
h. Project Contractor.
i. Project altitude.
j. Report date.

G. Project Record Documents: Record actual locations of flow measuring stations and balancing valves and rough setting.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION

3.01 GENERAL REQUIREMENTS

A. Perform total system balance in accordance with one of the following:
   1. AABC (NSTSB), AABC National Standards for Total System Balance.
   3. SMACNA (TAB).
   4. Maintain at least one copy of the standard to be used at project site at all times.

B. Begin work after completion of systems to be tested, adjusted, or balanced and complete work prior to Substantial Completion of the project.

C. Where HVAC systems and/or components interface with life safety systems, including fire and smoke detection, alarm, and control, coordinate scheduling and testing and inspection procedures with the authorities having jurisdiction.

D. TAB Agency Qualifications:
   1. Company specializing in the testing, adjusting, and balancing of systems specified in this section.
   2. Having minimum of three years documented experience.
   3. Certified by one of the following:
      a. AABC, Associated Air Balance Council: www.aabc.com
      b. NEBB, National Environmental Balancing Bureau: www.nebb.org

E. TAB Supervisor and Technician Qualifications: Certified by same organization as TAB agency.

3.02 EXAMINATION

A. Verify that systems are complete and operable before commencing work. Ensure the following conditions:
   1. Systems are started and operating in a safe and normal condition.
   2. Temperature control systems are installed complete and operable.
   3. Proper thermal overload protection is in place for electrical equipment.
   4. Final filters are clean and in place. If required, install temporary media in addition to final filters.
   5. Duct systems are clean of debris.
   6. Fans are rotating correctly.
   7. Fire and volume dampers are in place and open.
   8. Air coil fins are cleaned and combed.
   9. Access doors are closed and duct end caps are in place.
  10. Air outlets are installed and connected.
  11. Duct system leakage is minimized.
12. Hydronic systems are flushed, filled, and vented.
13. Pumps are rotating correctly.
14. Proper strainer baskets are clean and in place.
15. Service and balance valves are open.

B. Submit field reports. Report defects and deficiencies that will or could prevent proper system balance.

C. Beginning of work means acceptance of existing conditions.

3.03 PREPARATION

A. Hold a pre-balancing meeting at least one week prior to starting TAB work.
   1. Require attendance by all installers whose work will be tested, adjusted, or balanced.

B. Provide instruments required for testing, adjusting, and balancing operations. Make instruments available to Architect to facilitate spot checks during testing.

C. Provide additional balancing devices as required.

3.04 ADJUSTMENT TOLERANCES

A. Air Handling Systems: Adjust to within plus or minus 10 percent of design for supply systems and plus or minus 10 percent of design for return and exhaust systems.

B. Air Outlets and Inlets: Adjust total to within plus 10 percent and minus 10 percent of design to space. Adjust outlets and inlets in space to within plus or minus 10 percent of design.

C. Hydronic Systems: Adjust to within plus or minus 10 percent of design.

3.05 RECORDING AND ADJUSTING

A. Field Logs: Maintain written logs including:
   1. Running log of events and issues.
   2. Discrepancies, deficient or uncompleted work by others.
   4. Lists of completed tests.

B. Ensure recorded data represents actual measured or observed conditions.

C. Permanently mark settings of valves, dampers, and other adjustment devices allowing settings to be restored. Set and lock memory stops.

D. Mark on drawings the locations where traverse and other critical measurements were taken and cross reference the location in the final report.

E. After adjustment, take measurements to verify balance has not been disrupted or that such disruption has been rectified.

F. Leave systems in proper working order, replacing belt guards, closing access doors, closing doors to electrical switch boxes, and restoring thermostats to specified settings.

G. At final inspection, recheck random selections of data recorded in report. Recheck points or areas as selected and witnessed by the Owner.

H. Check and adjust systems approximately six months after final acceptance and submit report.

3.06 FUME HOOD TESTING (ON SITE)

A. General: Test fume hoods as installed to assess airflow velocity, airflow visualization, and level of containment. Perform tests with static mode (set sash position) conditions. Conduct testing as outlined below for 100% of the hoods provided in the Project.

B. Testing to be performed by firm certified by National Environmental Balancing Bureau - NEBB (FHT).

C. Preparation: Visit the project site to confirm that construction activities related to the fume hood system(s) and equipment are complete. Review design documents and Contractor's submittals. Verify that mechanical ventilation systems serving the space are functioning and operating in the normal mode. Notify Owner in writing, if conditions exist which preclude proper fume hood testing. Starting of testing constitutes acceptance of site conditions.
D. Testing Requirements:
1. Perform the following tests, in order:
   a. Airflow Velocity Test.
   b. Airflow Visualization Test.
   c. Tracer Gas Containment Test.
2. If more than one test procedure is selected, proceed to the next test only if any unsafe condition discovered during current test has been successfully rectified.
5. Tracer Gas Containment Test:
6. Reporting Requirements: Conform to Section 5 of NEBB (FHT) Fume Hood Testing Standard - current edition. Organize and include, at a minimum, the following information:
   a. Report Title.
   b. Report Certification.
   c. Table of Contents.
   e. Appropriate Forms.
   f. Instrument Calibration.
   g. List of Abbreviations Used.
   h. A room layout drawing for each tested item. Identify: walls; doors; fume hood(s); other present environmental enclosures (e.g. biological safety cabinet(s), laminar flow hood(s), canopy hood(s), etc.); location and airflow pattern of all air supply, return, and exhaust grilles, registers and diffusers.

3.07 AIR SYSTEM PROCEDURE
A. Adjust air handling and distribution systems to provide required or design supply, return, and exhaust air quantities at site altitude.
B. Make air quantity measurements in ducts by Pitot tube traverse of entire cross sectional area of duct.
C. Measure air quantities at air inlets and outlets.
D. Adjust distribution system to obtain uniform space temperatures free from objectionable drafts and noise.
E. Use volume control devices to regulate air quantities only to extend that adjustments do not create objectionable air motion or sound levels. Effect volume control by duct internal devices such as dampers and splitters.
F. Vary total system air quantities by adjustment of fan speeds. Provide drive changes required. Vary branch air quantities by damper regulation.
G. Provide system schematic with required and actual air quantities recorded at each outlet or inlet.
H. Measure static air pressure conditions on air supply units, including filter and coil pressure drops, and total pressure across the fan. Make allowances for 50 percent loading of filters.
I. Adjust outside air automatic dampers, outside air, return air, and exhaust dampers for design conditions.
J. Measure temperature conditions across outside air, return air, and exhaust dampers to check leakage.
K. Where modulating dampers are provided, take measurements and balance at extreme conditions. Balance variable volume systems at maximum air flow rate, full cooling, and at minimum air flow rate, full heating.
L. Measure building static pressure and adjust supply, return, and exhaust air systems to provide required relationship between each to maintain approximately 0.05 inches (12.5 Pa) positive static pressure near the building entries.

M. Check multi-zone units for motorized damper leakage. Adjust air quantities with mixing dampers set first for cooling, then heating, then modulating.

N. For variable air volume system powered units set volume controller to air flow setting indicated. Confirm connections properly made and confirm proper operation for automatic variable air volume temperature control.

O. On fan powered VAV boxes, adjust air flow switches for proper operation.

3.08 SCOPE

A. Test, adjust, and balance the following:
   1. Fire Pumps.
   2. Sprinkler Air Compressor.
   5. Air Cooled Refrigerant Condensers.
   6. Air Coils.
   7. Evaporative Humidifier.
   8. Air Handling Units.
   10. Air Filters.
   11. Air Terminal Units.
   12. Air Inlets and Outlets.
   13. Controls Compressor.

END OF SECTION
SECTION 23 0713
DUCT INSULATION

PART 1 GENERAL

1.01 SECTION INCLUDES
A. Duct insulation.
B. Duct liner.
C. Insulation jackets.

1.02 RELATED REQUIREMENTS
A. Section 01 6116 - Volatile Organic Compound (VOC) Content Restrictions.
B. Section 09 9113 - Exterior Painting: Painting insulation jackets.
C. Section 23 0553 - Identification for HVAC Piping and Equipment.

1.03 REFERENCE STANDARDS
B. ASTM B209M - Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate (Metric); 2014.
E. SMACNA (DCS) - HVAC Duct Construction Standards Metal and Flexible; 2005 (Revised 2009).

1.04 SUBMITTALS
A. See Section 01 3000 - Administrative Requirements, for submittal procedures.
B. Product Data: Provide product description, thermal characteristics, list of materials and thickness for each service, and locations.
C. Manufacturer's Instructions: Indicate installation procedures necessary to ensure acceptable workmanship and that installation standards will be achieved.

1.05 QUALITY ASSURANCE
A. Manufacturer Qualifications: Company specializing in manufacturing products of the type specified in this section with not less than three years of documented experience.

1.06 DELIVERY, STORAGE, AND HANDLING
A. Accept materials on site in original factory packaging, labelled with manufacturer's identification, including product density and thickness.
B. Protect insulation from weather and construction traffic, dirt, water, chemical, and mechanical damage, by storing in original wrapping.

1.07 FIELD CONDITIONS
A. Maintain ambient temperatures and conditions required by manufacturers of adhesives, mastics, and insulation cements.
B. Maintain temperature during and after installation for minimum period of 24 hours.

PART 2 PRODUCTS

2.01 REGULATORY REQUIREMENTS
A. Surface Burning Characteristics: Flame spread index/Smoke developed index of 25/50, maximum, when tested in accordance with ASTM E84 or UL 723.
2.02 GLASS FIBER, FLEXIBLE

A. Manufacturer:
5. Substitutions:  See Section 01 6000 - Product Requirements.

B. Insulation:  ASTM C553; flexible, noncombustible blanket.
1. 'K' ('Ksi') value:  0.36 at 75 degrees F (0.052 at 24 degrees C), when tested in accordance with ASTM C518.
3. Maximum Water Vapor Absorption:  5.0 percent by weight.

C. Vapor Barrier Jacket:
1. Kraft paper with glass fiber yarn and bonded to aluminized film.
2. Moisture Vapor Permeability:  0.02 perm inch (0.029 ng/Pa s m), when tested in accordance with ASTM E96/E96M.
3. Secure with pressure sensitive tape.

D. Vapor Barrier Tape:
1. Kraft paper reinforced with glass fiber yarn and bonded to aluminized film, with pressure sensitive rubber based adhesive.

E. Outdoor Vapor Barrier Mastic:
1. Vinyl emulsion type acrylic or mastic, compatible with insulation, black color.

F. Tie Wire:  Annealed steel, 16 gage, 0.0508 inch diameter (1.29 mm diameter).

2.03 GLASS FIBER, RIGID

A. Manufacturer:
5. Substitutions:  See Section 01 6000 - Product Requirements.

B. Insulation:  ASTM C612; rigid, noncombustible blanket.
1. 'K' ('Ksi') Value:  0.24 at 75 degrees F (0.036 at 24 degrees C), when tested in accordance with ASTM C518.
3. Maximum Water Vapor Absorption:  5.0 percent.
4. Maximum Density:  8.0 lb/cu ft (128 kg/cu m).

C. Vapor Barrier Jacket:
1. Kraft paper with glass fiber yarn and bonded to aluminized film.
2. Moisture Vapor Permeability:  0.02 perm inch (0.029 ng/Pa s m), when tested in accordance with ASTM E96/E96M.
3. Secure with pressure sensitive tape.

D. Vapor Barrier Tape:
1. Kraft paper reinforced with glass fiber yarn and bonded to aluminized film, with pressure sensitive rubber based adhesive.

E. Indoor Vapor Barrier Finish:
1. Cloth:  Untreated; 9 oz/sq yd (305 g/sq m) weight, glass fabric.
2. Vinyl emulsion type acrylic, compatible with insulation, black color.

2.04 FLEXIBLE ELASTOMERIC CELLULAR INSULATION

A. Manufacturer:
DUCT INSULATION

1. Armacell LLC; AP Armaflex; ______: www.armacell.us/#sle.
2. K-Flex USA LLC; Insul-Sheet: www.kflexusa.com/#sle.
3. Substitutions: See Section 01 6000 - Product Requirements.

B. Insulation: Preformed flexible elastomeric cellular rubber insulation complying with ASTM C534/C534M Grade 1, in sheet form.
   1. Minimum Service Temperature: Minus 40 degrees F (Minus 40 degrees C).

C. Elastomeric Foam Adhesive: Air dried, contact adhesive, compatible with insulation.

2.05 JACKETS

A. Canvas Jacket: UL listed 6 oz/sq yd (220 g/sq m) plain weave cotton fabric treated with dilute fire retardant lagging adhesive.
   1. Lagging Adhesive:
      a. Compatible with insulation.

B. Mineral Fiber (Outdoor) Jacket: Asphalt impregnated and coated sheet, 50 lb/square (2.45 kg/sq m).

   1. Thickness: 0.016 inch (0.40 mm) sheet.
   2. Finish: Smooth.
   3. Jointing: Longitudinal slip joints and 2 inch (50 mm) laps.
   4. Fittings: 0.016 inch (0.4 mm) thick die shaped fitting covers with factory attached protective liner.
   5. Metal Jacket Bands: 3/8 inch (10 mm) wide; 0.015 inch (0.38 mm) thick aluminum.
   6. Metal Jacket Bands: 3/8 inch (10 mm) wide; 0.010 inch (0.25 mm) thick stainless steel.

2.06 DUCT LINER

A. Manufacturers:
   1. Armacell LLC; AP Coiflex: www.armacell.us/#sle.
   4. Owens Corning Corporation; QuietR Rotary Duct Insulation; ______: www.ocbuildingspec.com/#sle.
   5. CertainTeed Corporation; ______: www.certainteed.com/#sle.
   6. Substitutions: See Section 01 6000 - Product Requirements.

B. Elastomeric Foam Insulation: Preformed flexible elastomeric cellular rubber insulation complying with ASTM C534/C534M Grade 1, in sheet form.
   1. Minimum Service Temperature: Minus 40 degrees F (Minus 40 degrees C).
   3. Fungal Resistance: No growth when tested according to ASTM G21.
   4. Apparent Thermal Conductivity: Maximum of 0.28 at 75 degrees F (0.045 at 24 degrees C).
   5. Minimum Noise Reduction Coefficients:
      a. 1/2 inch (13 mm) Thickness: 0.30.
      b. 1 inch (25 mm) Thickness: 0.40.
      c. 1-1/2 inches (40 mm) Thickness: 0.50.
      d. 2 inch (50 mm) Thickness: 0.60.
   6. Erosion Resistance: Does not show evidence of breaking away, flaking off, or delamination at velocities of 10,000 fpm (50.8 m/s) per ASTM C1071.

PART 3  EXECUTION

3.01  EXAMINATION
   A. Verify that ducts have been tested before applying insulation materials.
   B. Verify that surfaces are clean, foreign material removed, and dry.

3.02  INSTALLATION
   A. Install in accordance with manufacturer's instructions.
   B. Install in accordance with NAIMA National Insulation Standards.
   C. Insulated ducts conveying air below ambient temperature:
      1. Provide insulation with vapor barrier jackets.
      2. Finish with tape and vapor barrier jacket.
      3. Continue insulation through walls, sleeves, hangers, and other duct penetrations.
      4. Insulate entire system including fittings, joints, flanges, fire dampers, flexible connections, and expansion joints.
   D. Insulated ducts conveying air above ambient temperature:
      1. Provide with or without standard vapor barrier jacket.
      2. Insulate fittings and joints. Where service access is required, bevel and seal ends of insulation.
   E. Ducts Exposed in Mechanical Equipment Rooms or Finished Spaces (below 10 feet above finished floor) ((below 3 meters above finished floor)): Finish with canvas jacket sized for finish painting.
   F. Exterior Applications: Provide insulation with vapor barrier jacket. Cover with with calked aluminum jacket with seams located on bottom side of horizontal duct section.
   G. External Duct Insulation Application:
      1. Secure insulation with vapor barrier with wires and seal jacket joints with vapor barrier adhesive or tape to match jacket.
      2. Secure insulation without vapor barrier with staples, tape, or wires.
      3. Install without sag on underside of duct. Use adhesive or mechanical fasteners where necessary to prevent sagging. Lift duct off trapeze hangers and insert spacers.
      4. Seal vapor barrier penetrations by mechanical fasteners with vapor barrier adhesive.
      5. Stop and point insulation around access doors and damper operators to allow operation without disturbing wrapping.
   H. Duct and Plenum Liner Application:
      1. Adhere insulation with adhesive for 90 percent coverage.
      2. Secure insulation with mechanical liner fasteners. Refer to SMACNA (DCS) for spacing.
      4. Seal liner surface penetrations with adhesive.
      5. Duct dimensions indicated are net inside dimensions required for air flow. Increase duct size to allow for insulation thickness.

END OF SECTION
SECTION 23 2300
REFRIGERANT PIPING

PART 1 GENERAL

1.01 SECTION INCLUDES
A. Piping.
B. Refrigerant.
C. Moisture and liquid indicators.
D. Valves.
E. Strainers.
F. Check valves.
G. Pressure regulators.
H. Pressure relief valves.
I. Filter-driers.
J. Solenoid valves.
K. Expansion valves.
L. Flexible connections.

1.02 REFERENCE STANDARDS
F. ASME B31.5 - Refrigeration Piping and Heat Transfer Components; 2016.
H. ASTM B88M - Standard Specification for Seamless Copper Water Tube (Metric); 2016.
J. AWS A5.8M/A5.8 - Specification for Filler Metals for Brazing and Braze Welding; 2011 (Amended 2012).

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

1.04 QUALITY ASSURANCE
A. Designer Qualifications: Design piping system under direct supervision of a Professional Engineer experienced in design of this type of work.

PART 2 PRODUCTS

2.01 PIPING
A. Copper Tube: ASTM B280, H58 hard drawn or O60 soft annealed.
   2. Joints: Brazed, AWS A5.8M/A5.8 BCuP silver/phosphorus/copper alloy.
B. Copper Tube to 7/8 inch (22 mm) OD: ASTM B88 (ASTM B88M), Type K (A), annealed.
C. Pipe Supports and Anchors:
1. Hangers for Pipe Sizes 1/2 to 1-1/2 Inch (13 to 38 mm): Malleable iron adjustable swivel, split ring.
2. Hangers for Pipe Sizes 2 Inches (50 mm) and Over: Carbon steel, adjustable, clevis.
3. Multiple or Trapeze Hangers: Steel channels with welded spacers and hanger rods.

2.02 REFRIGERANT

A. Refrigerant: Use only refrigerants that have ozone depletion potential (ODP) of zero and global warming potential (GWP) of less than 50.

2.03 MOISTURE AND LIQUID INDICATORS

A. Manufacturers:
   3. Sporlan, a Division of Parker Hannifin; _____: www.parker.com/#sle.
   4. Substitutions: See Section 01 6000 - Product Requirements.

B. Indicators: Single port type, UL listed, with copper or brass body, flared or solder ends, sight glass, color coded paper moisture indicator with removable element cartridge and plastic cap; for maximum temperature of 200 degrees F (93 degrees C) and maximum working pressure of 500 psi (3450 kPa).

2.04 VALVES

A. Manufacturers:
   4. Substitutions: See Section 01 6000 - Product Requirements.

B. Diaphragm Packless Valves:
   1. UL listed, globe or angle pattern, forged brass body and bonnet, phosphor bronze and stainless steel diaphragms, rising stem and handwheel, stainless steel spring, nylon seat disc, solder or flared ends, with positive backseating; for maximum working pressure of 500 psi (3450 kPa) and maximum temperature of 275 degrees F (135 degrees C).

C. Packed Angle Valves:
   1. Forged brass or nickel plated forged steel, forged brass seal caps with copper gasket, rising stem and seat with backseating, molded stem packing, solder or flared ends; for maximum working pressure of 500 psi (3450 kPa) and maximum temperature of 275 degrees F (135 degrees C).

D. Ball Valves:
   1. Two piece bolted forged brass body with teflon ball seals and copper tube extensions, brass bonnet and seal cap, chrome plated ball, stem with neoprene ring stem seals; for maximum working pressure of 500 psi (3450 kPa) and maximum temperature of 300 degrees F (149 degrees C).

E. Service Valves:
   1. Forged brass body with copper stubs, brass caps, removable valve core, integral ball check valve, flared or solder ends, for maximum pressure of 500 psi (3450 kPa).

2.05 STRAINERS

A. Manufacturers:
   3. Sporlan, a Division of Parker Hannifin; _____: www.parker.com/#sle.
   4. Substitutions: See Section 01 6000 - Product Requirements.

B. Straight Line or Angle Line Type:
1. Brass or steel shell, steel cap and flange, and replaceable cartridge, with screen of stainless steel wire or monel reinforced with brass; for maximum working pressure of 430 psi (2960 kPa).

C. Straight Line, Non-Cleanable Type:
   1. Steel shell, copper plated fittings, stainless steel wire screen, for maximum working pressure of _____ psi (_____ kPa).

2.06 CHECK VALVES
A. Manufacturers:
   3. Sporlan, a Division of Parker Hannifin; _____:  www.parker.com/#sle.
   4. Substitutions: See Section 01 6000 - Product Requirements.

B. Globe Type:
   1. Cast bronze or forged brass body, forged brass cap with neoprene seal, brass guide and disc holder, phosphor-bronze or stainless steel spring, teflon seat disc; for maximum temperature of 300 degrees F (149 degrees C) and maximum working pressure of 425 psi (2930 kPa).

C. Straight Through Type:
   1. Brass body and disc, phosphor-bronze or stainless steel spring, neoprene seat; for maximum working pressure of 500 psi (3450 kPa) and maximum temperature of 200 degrees F (93 degrees C).

2.07 PRESSURE REGULATORS
A. Manufacturers:
   3. Sporlan, a Division of Parker Hannifin; _____:  www.parker.com/#sle.
   4. Substitutions: See Section 01 6000 - Product Requirements.

B. Brass body, stainless steel diaphragm, direct acting, adjustable over 0 to 80 psi (0 to 550 kPa) range, for maximum working pressure of 450 psi (3100 kPa).

2.08 PRESSURE RELIEF VALVES
A. Straight Through or Angle Type: Brass body and disc, neoprene seat, factory sealed and stamped with ASME UV and National Board Certification NB, selected to ASHRAE Std 15, with standard setting of 235 psi (1620 kPa).

2.09 FILTER-DRIERS
A. Manufacturers:
   1. Flow Controls Division of Emerson Electric; _____:  www.emersonflowcontrols.com/#sle.
   3. Sporlan, a Division of Parker Hannifin; _____:  www.parker.com/#sle.
   4. Substitutions: See Section 01 6000 - Product Requirements.

B. Performance:
   1. Pressure Drop: 2 psi (14 kPa), maximum, when operating at full connected evaporator capacity.
   2. Design Working Pressure: 350 psi (2410 kPa), minimum.

C. Cores: Molded or loose-fill molecular sieve desiccant compatible with refrigerant, activated alumina, activated charcoal, and filtration to 40 microns, with secondary filtration to 20 microns; of construction that will not pass into refrigerant lines.

D. Construction: UL listed.
   1. Connections: As specified for applicable pipe type.
2.10 SOLENOID VALVES

A. Manufacturers:
   1. Flow Controls Division of Emerson Electric; ______: www.emersonflowcontrols.com/#sle.
   3. Sporlan, a Division of Parker Hannifin; ______: www.parker.com/#sle.
   4. Substitutions: See Section 01 6000 - Product Requirements.

B. Valve: AHRI 760 I-P, pilot operated, copper, brass or steel body and internal parts, synthetic seat, stainless steel stem and plunger assembly (permitting manual operation in case of coil failure), integral strainer, with flared, solder, or threaded ends; for maximum working pressure of 500 psi (3450 kPa).

2.11 EXPANSION VALVES

A. Manufacturers:
   1. Flow Controls Division of Emerson Electric; ______: www.emersonflowcontrols.com/#sle.
   3. Sporlan, a Division of Parker Hannifin; ______: www.parker.com/#sle.
   4. Substitutions: See Section 01 6000 - Product Requirements.

B. Angle or Straight Through Type: AHRI 750; design suitable for refrigerant, brass body, internal or external equalizer, bleed hole, adjustable superheat setting, replaceable inlet strainer, with non-replaceable capillary tube and remote sensing bulb and remote bulb well.

C. Selection: Evaluate refrigerant pressure drop through system to determine available pressure drop across valve. Select valve for maximum load at design operating pressure and minimum 10 degrees F (6 degrees C) superheat. Select to avoid being undersized at full load and excessively oversized at part load.

2.12 FLEXIBLE CONNECTORS

A. Manufacturers:
   1. Circuit Hydraulics, Ltd; ______: www.circuit-hydraulics.co.uk.
   2. Flexicraft Industries; ______: www.flexicraft.com/#sle.
   4. Substitutions: See Section 01 6000 - Product Requirements.

B. Corrugated stainless steel hose with single layer of stainless steel exterior braiding, minimum 9 inches (230 mm) long with copper tube ends; for maximum working pressure of 500 psi (3450 kPa).

PART 3 EXECUTION

3.01 INSTALLATION

A. Install refrigeration specialties in accordance with manufacturer's instructions.

B. Route piping in orderly manner, with plumbing parallel to building structure, and maintain gradient.

C. Install piping to conserve building space and avoid interference with use of space.

D. Install piping to allow for expansion and contraction without stressing pipe, joints, or connected equipment.

3.02 FIELD QUALITY CONTROL

A. See Section 01 4000 - Quality Requirements, for additional requirements.

B. Test refrigeration system in accordance with ASME B31.5.

C. Pressure test system with dry nitrogen to 200 psi (1380 kPa). Perform final tests at 27 inches (92 kPa) vacuum and 200 psi (1380 kPa) using halide torch. Test to no leakage.

END OF SECTION
SECTION 23 3100  
HVAC DUCTS AND CASINGS

PART 1  GENERAL

1.01  SECTION INCLUDES
A. Metal ductwork.
B. Casing and plenums.
C. Duct cleaning.

1.02  RELATED REQUIREMENTS
A. Section 23 3300 - Air Duct Accessories.
B. Section 23 3700 - Air Outlets and Inlets.

1.03  REFERENCE STANDARDS
D. SMACNA (DCS) - HVAC Duct Construction Standards Metal and Flexible; 2005 (Revised 2009).
E. UL 181 - Standard for Factory-Made Air Ducts and Air Connectors; current edition, including all revisions.

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

1.05  QUALITY ASSURANCE

PART 2  PRODUCTS

2.01  DUCT ASSEMBLIES
A. Regulatory Requirements: Construct ductwork to NFPA 90A standards.
B. Ducts: Galvanized steel, unless otherwise indicated.
C. Low Pressure Supply (Heating Systems): 1/2 inch w.g. (125 Pa) pressure class, galvanized steel.
D. Low Pressure Supply (System with Cooling Coils): 1/2 inch w.g. (125 Pa) pressure class, galvanized steel.
E. Medium and High Pressure Supply: 1/2 inch w.g. (125 Pa) pressure class, galvanized steel.
F. Return and Relief: 1/2 inch w.g. (125 Pa) pressure class, galvanized steel.
G. General Exhaust: 1/2 inch w.g. (125 Pa) pressure class, galvanized steel.
H. Outside Air Intake: 1/2 inch w.g. (125 Pa) pressure class, galvanized steel.

2.02  MATERIALS
A. Galvanized Steel for Ducts: Hot-dipped galvanized steel sheet, ASTM A653/A653M FS Type B, with G60/Z180 coating.

2.03  DUCTWORK FABRICATION
A. Fabricate and support in accordance with SMACNA (DCS) and as indicated.
B. Provide duct material, gages, reinforcing, and sealing for operating pressures indicated.
C. Construct T's, bends, and elbows with radius of not less than 1-1/2 times width of duct on centerline. Where not possible and where rectangular elbows must be used, provide air foil turning vanes of perforated metal with glass fiber insulation.
D. Increase duct sizes gradually, not exceeding 15 degrees divergence wherever possible; maximum 30 degrees divergence upstream of equipment and 45 degrees convergence downstream.

E. Fabricate continuously welded round and oval duct fittings in accordance with SMACNA (DCS).

2.04 MANUFACTURED DUCTWORK AND FITTINGS

A. Double Wall Insulated Round Ducts: Round spiral lockseam duct with galvanized steel outer wall, perforated galvanized steel inner wall; fitting with solid inner wall.
   1. Manufacture in accordance with SMACNA (DCS).

B. Flexible Ducts: UL 181, Class 1, aluminum laminate and polyester film with latex adhesive supported by helically wound spring steel wire.
   1. Insulation: Fiberglass insulation with polyethylene vapor barrier film.
   2. Pressure Rating: 10 inches WG (2.50 kPa) positive and 1.0 inches WG (250 Pa) negative.
   3. Maximum Velocity: 4000 fpm (20.3 m/sec).
   4. Temperature Range: Minus 20 degrees F to 210 degrees F (Minus 28 degrees C to 99 degrees C).

2.05 CASINGS

A. Fabricate casings in accordance with SMACNA (DCS) and construct for operating pressures indicated.

B. Mount floor mounted casings on 4 inch (100 mm) high concrete curbs. At floor, rivet panels on 8 inch (200 mm) centers to angles. Where floors are acoustically insulated, provide liner of galvanized 18 gage, 0.0478 inch (1.21 mm) expanded metal mesh supported at 12 inch (300 mm) centers, turned up 12 inches (300 mm) at sides with sheet metal shields.

C. Reinforce door frames with steel angles tied to horizontal and vertical plenum supporting angles. Install hinged access doors where indicated or required for access to equipment for cleaning and inspection.

PART 3 EXECUTION

3.01 INSTALLATION

A. Install, support, and seal ducts in accordance with SMACNA (DCS).

B. Install in accordance with manufacturer's instructions.

C. During construction provide temporary closures of metal or taped polyethylene on open ductwork to prevent construction dust from entering ductwork system.

D. Duct sizes indicated are inside clear dimensions. For lined ducts, maintain sizes inside lining.

E. Locate ducts with sufficient space around equipment to allow normal operating and maintenance activities.

3.02 CLEANING

A. Clean duct systems with high power vacuum machines. Protect equipment that could be harmed by excessive dirt with filters, or bypass during cleaning. Provide adequate access into ductwork for cleaning purposes.

END OF SECTION
SECTION 23 3300
AIR DUCT ACCESSORIES

PART 1 GENERAL

1.01 SECTION INCLUDES
A. Air turning devices/extractors.
B. Combination fire and smoke dampers.
C. Duct access doors.
D. Duct test holes.
E. Fire dampers.
F. Flexible duct connections.
G. Smoke dampers.
H. Volume control dampers.
I. Miscellaneous products:
   1. Internal strut end plugs.
   2. Duct opening closure film.

1.02 RELATED REQUIREMENTS
A. Section 23 3100 - HVAC Ducts and Casings.
B. Section 23 3600 - Air Terminal Units: Pressure regulating damper assemblies.

1.03 REFERENCE STANDARDS
E. SMACNA (DCS) - HVAC Duct Construction Standards Metal and Flexible; 2005 (Revised 2009).
F. UL 33 - Safety Heat Responsive Links for Fire-Protection Service; Current Edition, Including All Revisions.

1.04 SUBMITTALS
A. See Section 01 3000 - Administrative Requirements, for submittal procedures.
B. Product Data: Provide for shop fabricated assemblies including volume control dampers. Include electrical characteristics and connection requirements.
C. Shop Drawings: Indicate for shop fabricated assemblies including volume control dampers.
D. Manufacturer's Installation Instructions: Provide instructions for fire dampers.
E. Project Record Drawings: Record actual locations of access doors and test holes.
F. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
   1. See Section 01 6000 - Product Requirements, for additional provisions.
   2. Extra Fusible Links: One of each type and size.

Bidding Documents - October 31st 2018
1.05 QUALITY ASSURANCE
   A. Manufacturer Qualifications: Company specializing in manufacturing the type of products specified in this section, with minimum three years of documented experience.
   B. Products Requiring Electrical Connection: Listed and classified by Underwriters Laboratories Inc. as suitable for the purpose specified and indicated.

1.06 DELIVERY, STORAGE, AND HANDLING
   A. Protect dampers from damage to operating linkages and blades.

PART 2 PRODUCTS

2.01 AIR TURNING DEVICES/EXTRACTORS
   A. Manufacturers:
      1. Carlisle HVAC Products; Dynair Hollow Vane and Rail (Double Wall Vane): www.carlislehvac.com/#sle.
      7. Substitutions: See Section 01 6000 - Product Requirements.
   B. Multi-blade device with blades aligned in short dimension; steel construction; with individually adjustable blades, mounting straps.

2.02 COMBINATION FIRE AND SMOKE DAMPERS
   A. Manufacturers:
      4. NCA, a brand of Metal Industries Inc: _____: www.ncamfg.com/#sle.
      7. Substitutions: See Section 01 6000 - Product Requirements.
   B. Fabricate in accordance with NFPA 90A, UL 555, UL 555S, and as indicated.
   C. Provide factory sleeve and collar for each damper.
   D. Multiple Blade Dampers: Fabricate with 16 gage, 0.0598 inch (1.52 mm) galvanized steel frame and blades, oil-impregnated bronze or stainless steel sleeve bearings and plated steel axles, stainless steel jamb seals, 1/8 by 1/2 inch (3.2 by 12.7 mm) plated steel concealed linkage, stainless steel closure spring, blade stops, and lock, and 1/2 inch (12.7 mm) actuator shaft.
   E. Operators: UL listed and labelled spring return pneumatic type suitable for operation on 0-20 psig (0-140 kPa) instrument air. Provide end switches to indicate damper position. Locate damper operator on interior of duct and link to damper operating shaft.
   F. Normally Closed Smoke Responsive Fire Dampers: Curtain type, opening by gravity upon actuation of electro thermal link, flexible stainless steel blade edge seals to provide constant sealing pressure.
   G. Normally Open Smoke Responsive Fire Dampers: Curtain type, closing upon actuation of electro thermal link, flexible stainless steel blade edge seals to provide constant sealing pressure, stainless steel springs with locking devices to ensure positive closure for units mounted horizontally.
   H. Electro Thermal Link: Fusible link melting at 165 degrees F (74 degrees C); 120 volts, single phase, 60 Hz; UL listed and labeled.
2.03 DUCT ACCESS DOORS

A. Manufacturers:
   1. Acudor Products Inc, a Division of Nelson Industrial Inc; ______: www.acudor.com/#sle.
   2. Elgen Manufacturing, Inc; ______: www.elgenmfg.com/#sle.
   5. Ruskin Company, a brand of Johnson Controls; ______: www.ruskin.com/#sle.
   6. SEMCO LLC; ______: www.semcohvac.com/#sle.
   8. Substitutions: See Section 01 6000 - Product Requirements.

B. Fabricate in accordance with SMACNA (DCS) and as indicated.

C. Access doors with sheet metal screw fasteners are not acceptable.

2.04 DUCT TEST HOLES

A. Temporary Test Holes: Cut or drill in ducts as required. Cap with neat patches, neoprene plugs, threaded plugs, or threaded or twist-on metal caps.

B. Permanent Test Holes: Factory fabricated, air tight flanged fittings with screw cap. Provide extended neck fittings to clear insulation.

   1. Manufacturers:
      a. Carlisle HVAC Products; Dynair Test Port with Red Cap with O-Ring Seal: www.carlislehvac.com/#sle.
      b. Substitutions: See Section 01 6000 - Product Requirements.

2.05 FIRE DAMPERS

A. Manufacturers:
   1. Lloyd Industries, Inc; ______: www.firedamper.com/#sle.
   2. Louvers & Dampers, Inc, a brand of Mestek, Inc; ______: www.louvers-dampers.com/#sle.
   4. NCA, a brand of Metal Industries Inc; ______: www.ncamfg.com/#sle.
   5. Pottorf; ______: www.pottorff.com/#sle.
   8. Substitutions: See Section 01 6000 - Product Requirements.

B. Fabricate in accordance with NFPA 90A and UL 555, and as indicated.

C. Ceiling Dampers: Galvanized steel, 22 gage, 0.0299 inch (0.76 mm) frame and 16 gage, 0.0598 inch (1.52 mm) flap, two layers 0.125 inch (3.2 mm) ceramic fiber on top side and one layer on bottom side for round flaps, with locking clip.

D. Horizontal Dampers: Galvanized steel, 22 gage, 0.0299 inch (0.76 mm) frame, stainless steel closure spring, and lightweight, heat retardant non-asbestos fabric blanket.

E. Curtain Type Dampers: Galvanized steel with interlocking blades. Provide stainless steel closure springs and latches for horizontal installations. Configure with blades out of air stream except for 1.0 inch (250 Pa) pressure class ducts up to 12 inches (300 mm) in height.

F. Multiple Blade Dampers: 16 gage, 0.0598 inch (1.52 mm) galvanized steel frame and blades, oil-impregnated bronze or stainless steel sleeve bearings and plated steel axles, 1/8 by 1/2 inch (3.2 by 12.7 mm) plated steel concealed linkage, stainless steel closure spring, blade stops, and lock.

G. Fusible Links: UL 33, separate at 160 degrees F (71 degrees C) with adjustable link straps for combination fire/balancing dampers.

2.06 FLEXIBLE DUCT CONNECTIONS

A. Manufacturers:
2. Elgen Manufacturing, Inc; ______ : www.elgenmfg.com/#sle.
3. Substitutions: See Section 01 6000 - Product Requirements.

B. Fabricate in accordance with SMACNA (DCS) and as indicated.

C. Flexible Duct Connections: Fabric crimped into metal edging strip.
   1. Fabric: UL listed fire-retardant neoprene coated woven glass fiber fabric to NFPA 90A, minimum density 30 oz per sq yd (1.0 kg/sq m).
      a. Net Fabric Width: Approximately 2 inches (50 mm) wide.
   2. Metal: 3 inches (75 mm) wide, 24 gage, 0.0239 inch (0.61 mm) thick galvanized steel.

D. Leaded Vinyl Sheet: Minimum 0.55 inch (14 mm) thick, 0.87 lbs per sq ft (4.2 kg/sq m), 10 dB attenuation in 10 to 10,000 Hz range.

E. Maximum Installed Length: 14 inch (356 mm).

2.07 SMOKE DAMPERS

A. Manufacturers:
   4. Substitutions: See Section 01 6000 - Product Requirements.

B. Fabricate in accordance with NFPA 90A and UL 555S, and as indicated.

C. Dampers: UL Class 1 airfoil blade type smoke damper, normally open automatically operated by pneumatic actuator.

D. Electro Thermal Link: Fusible link melting at 165 degrees F (74 degrees C); 120 volts, single phase, 60 Hz; UL listed and labeled.

2.08 VOLUME CONTROL DAMPERS

A. Manufacturers:
   3. NCA, a brand of Metal Industries Inc; ______ : www.ncamfg.com/#sle.
   5. Substitutions: See Section 01 6000 - Product Requirements.

B. Fabricate in accordance with SMACNA (DCS) and as indicated.

C. Splitter Dampers:
   1. Material: Same gage as duct to 24 inches (600 mm) size in either direction, and two gages heavier for sizes over 24 inches (600 mm).
   2. Blade: Fabricate of single thickness sheet metal to streamline shape, secured with continuous hinge or rod.
   3. Operator: Minimum 1/4 inch (6 mm) diameter rod in self aligning, universal joint action, flanged bushing with set screw.

D. Single Blade Dampers:
   1. Fabricate for duct sizes up to 6 by 30 inch (150 by 760 mm).
   2. Blade: 24 gage, 0.0239 inch (0.61 mm), minimum.

E. Multi-Blade Damper: Fabricate of opposed blade pattern with maximum blade sizes 8 by 72 inch (200 by 1825 mm). Assemble center and edge crimped blades in prime coated or galvanized channel frame with suitable hardware.
   1. Blade: 18 gage, 0.0478 inch (1.21 mm), minimum.
F. End Bearings: Except in round ducts 12 inches (300 mm) and smaller, provide end bearings. On multiple blade dampers, provide oil-impregnated nylon, thermoplastic elastomer, or sintered bronze bearings.
   1. Manufacturers:
      c. Substitutions: See Section 01 6000 - Product Requirements.

G. Quadrants:
   1. Provide locking, indicating quadrant regulators on single and multi-blade dampers.
   2. On insulated ducts mount quadrant regulators on stand-off mounting brackets, bases, or adapters.
   3. Where rod lengths exceed 30 inches (750 mm) provide regulator at both ends.
   4. Manufacturers:
      a. Carlisle HVAC Products; Dynair Double Shear Rattle Free Quadrants 1/2 inch: www.carlislehvac.com/#sle.
      b. Substitutions: See Section 01 6000 - Product Requirements.

H. Constant Airflow Regulators:
   1. General Requirements:
      a. Provide bi-directional, air balancing regulator for pressure independent air volume control.
      b. Complies with UL 2043 for heat and smoke release.
      c. Complies with AMCA 500-D for the allowable leakage rates.
      d. Airflow regulator to be field adjustable.
   2. Construction:
      a. Nominal Diameter: 4 inch (104 mm).
      b. Frame: Thermoplastic resin in compliance with UL 94.
      c. Blade: Thermoplastic resin in compliance with UL 94.
      e. Outer Seal: Removable rubber gasket-type around circumference of damper.
      f. Spring: Stainless steel leaf-type.
      g. Temperature Range: 25 degrees F to 150 degrees F (Minus 4 degrees C to 65 degrees C).
      h. Operating Range: 0.2 inch W.C. to 2.0 inch W.C. (50 Pa to 498 Pa).
   3. Optional Accessories:
      a. Provide airflow regulators with rectangular to round transitions.
   4. Manufacturers:
      a. Automatic Airflow Balancing, a brand of Metal Industries Inc; _____: www.airflowbalancing.com/#sle.
      b. Substitutions: See Section 01 6000 - Product Requirements.

2.09 MISCELLANEOUS PRODUCTS

A. Internal Strut End Plugs: Combination end-mounting and sealing plugs for metal conduit used as internal reinforcement struts for metal ducts; plug crimped inside conduit with outside gasketed washer seal.
   1. Manufacturers:
      b. Substitutions: See Section 01 6000 - Product Requirements.

B. Duct Opening Closure Film: Mold-resistant, self-adhesive film to keep debris out of ducts during construction.
   1. Thickness: 2 mils (0.6 mm).
   2. High tack water based adhesive.
   3. UV stable light blue color.
5. Manufacturers:
   a. Carlisle HVAC Products; Dynair Duct Protection Film: www.carlislehvac.com/#sle.
   b. Substitutions: See Section 01 6000 - Product Requirements.

PART 3 EXECUTION

3.01 PREPARATION
   A. Verify that electric power is available and of the correct characteristics.

3.02 INSTALLATION
   A. Install accessories in accordance with manufacturer's instructions, NFPA 90A, and follow SMACNA (DCS). Refer to Section 23 3100 for duct construction and pressure class.
   B. Provide duct access doors for inspection and cleaning before and after filters, coils, fans, automatic dampers, at fire dampers, combination fire and smoke dampers, and elsewhere as indicated. Provide for cleaning kitchen exhaust ducts in accordance with NFPA 96. Provide minimum 8 by 8 inch (200 by 200 mm) size for hand access, size for shoulder access, and as indicated. Provide 4 by 4 inch (100 by 100 mm) for balancing dampers only. Review locations prior to fabrication.
   C. Provide duct test holes where indicated and required for testing and balancing purposes.
   D. Provide fire dampers, combination fire and smoke dampers, and smoke dampers at locations indicated, where ducts and outlets pass through fire rated components, and where required by Authorities Having Jurisdiction. Install with required perimeter mounting angles, sleeves, breakaway duct connections, corrosion resistant springs, bearings, bushings and hinges.
   E. Install smoke dampers and combination smoke and fire dampers in accordance with NFPA 92.
   F. Demonstrate re-setting of fire dampers to Owner's representative.
   G. At fans and motorized equipment associated with ducts, provide flexible duct connections immediately adjacent to the equipment.
   H. At equipment supported by vibration isolators, provide flexible duct connections immediately adjacent to the equipment.
      1. Refer to Section 22 0548.
   I. For fans developing static pressures of 5.0 inches (1250 Pa) and over, cover flexible connections with leaded vinyl sheet, held in place with metal straps.
   J. Provide balancing dampers at points on supply, return, and exhaust systems where branches are taken from larger ducts as required for air balancing. Install minimum 2 duct widths from duct take-off.
   K. Use splitter dampers only where indicated.
   L. Provide balancing dampers on high velocity systems where indicated. Refer to Section 23 3600 - Air Terminal Units.
   M. Provide balancing dampers on duct take-off to diffusers, grilles, and registers, regardless of whether dampers are specified as part of the diffuser, grille, or register assembly.

END OF SECTION
SECTION 23 3423
HVAC POWER VENTILATORS

PART 1 GENERAL

1.01 SECTION INCLUDES
A. Inline centrifugal fans.

1.02 RELATED REQUIREMENTS
A. Section 23 0513 - Common Motor Requirements for HVAC Equipment.
B. Section 23 3300 - Air Duct Accessories: Backdraft dampers.
C. Section 26 0583 - Wiring Connections: Electrical characteristics and wiring connections.

1.03 REFERENCE STANDARDS
A. AMCA (DIR) - (Directory of) Products Licensed Under AMCA International Certified Ratings Program; 2015.
C. AMCA 204 - Balance Quality and Vibration Levels for Fans; 2005.
H. AMCA 301 - Methods for Calculating Fan Sound Ratings from Laboratory Test Data; 2014.
J. ANSI Z9.5 - Laboratory Ventilation; 2012.
K. NEMA MG 1 - Motors and Generators; 2017.
L. NEMA 250 - Enclosures for Electrical Equipment (1000 Volts Maximum); 2014.
N. UL 705 - Power Ventilators; Current Edition, Including All Revisions.

1.04 ADMINISTRATIVE REQUIREMENTS
A. Preinstallation Meeting: Conduct a preinstallation meeting one week prior to the start of the work of this section; require attendance by all affected installers.
B. Sequencing: Ensure that utility connections are achieved in an orderly and expeditious manner.

1.05 SUBMITTALS
A. See Section 01 3000 - Administrative Requirements, for submittal procedures.
B. Product Data: Provide data on fans and accessories including fan curves with specified operating point clearly plotted, power, RPM, sound power levels at rated capacity, and electrical characteristics and connection requirements.
C. Manufacturer's Instructions: Indicate installation instructions.
D. Maintenance Data: Include instructions for lubrication, motor and drive replacement, spare parts list, and wiring diagrams.
E. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
1. See Section 01 6000 - Product Requirements, for additional provisions.
2. Extra Fan Belts: One set for each individual fan.

1.06 QUALITY ASSURANCE
A. Manufacturer Qualifications: Company specializing in manufacturing the type of products specified in this section, with minimum three years of documented experience.

1.07 FIELD CONDITIONS
A. Permanent ventilators may not be used for ventilation during construction.

PART 2 PRODUCTS

2.01 POWER VENTILATORS - GENERAL
A. Manufacturers:
   3. PennBarry, Division of Air System Components; _____: www.pennbarry.com/#sle.
   4. Substitutions: See Section 01 6000 - Product Requirements.
B. Static and Dynamically Balanced: AMCA 204 - Balance Quality and Vibration Levels for Fans.
C. Performance Ratings: Determined in accordance with AMCA 210 and bearing the AMCA Certified Rating Seal.
D. Sound Ratings: AMCA 301, tested to AMCA 300 and bearing AMCA Certified Sound Rating Seal.
E. Fabrication: Conform to AMCA 99.
F. UL Compliance: UL listed and labeled, designed, manufactured, and tested in accordance with UL 705.
G. Electrical Components: Listed and classified by Underwriters Laboratories Inc. as suitable for the purpose specified and indicated.
H. Enclosed Safety Switches: Conform to NEMA 250.
I. Kitchen Hood Exhaust Fans: Comply with requirements of NFPA 96 and UL 762.

2.02 INLINE CENTRIFUGAL FANS
A. Manufacturers:
   2. Loren Cook Company; _____: www.lorencook.com/#sle.
   3. PennBarry, Division of Air System Components; _____: www.pennbarry.com/#sle.
   5. Substitutions: See Section 01 6000 - Product Requirements.
B. Centrifugal Fan Unit: V-belt or direct driven with galvanized steel housing lined with acoustic insulation, resilient mounted motor, gravity backdraft damper in discharge.
C. Disconnect Switch: Cord and plug in housing for thermal overload protected motor and wall mounted switch.
D. Sheaves: Cast iron or steel, dynamically balanced, bored to fit shafts and keyed; variable and adjustable pitch motor sheaves selected so required rpm is obtained with sheaves set at mid-position; fan shaft with self-aligning pre-lubricated ball bearings.

PART 3 EXECUTION

3.01 INSTALLATION
A. Install in accordance with manufacturer's instructions.
B. Hung Cabinet Fans:
   1. Install fans with resilient mountings and flexible electrical leads. Refer to Section 22 0548.
2. Install flexible connections specified in Section 23 3300 between fan and ductwork. Ensure metal bands of connectors are parallel with minimum one inch (25 mm) flex between ductwork and fan while running.

C. Provide sheaves required for final air balance.

D. Install backdraft dampers on inlet to roof and wall exhausters.

E. Provide backdraft dampers on outlet from cabinet and ceiling exhauster fans and as indicated.

3.02 SCHEDULES

A. Drawing Code:

B. Manufacturer:

C. Model:

D. Fan Type:

E. Hood/Housing:

F. Air Flow Capacity:

G. Static Pressure:

H. Drive:

I. Fan Tip Speed:

J. Fan RPM:

K. Motor hp:

END OF SECTION
SECTION 23 3700
AIR OUTLETS AND INLETS

PART 1  GENERAL

1.01  SECTION INCLUDES
A. Diffusers.
B. Registers/grilles.
C. Louvers.

1.02  RELATED REQUIREMENTS
A. Section 09 9123 - Interior Painting: Painting of ducts visible behind outlets and inlets.

1.03  REFERENCE STANDARDS
A. AHRI 880 (I-P) - Performance Rating of Air Terminals; 2011 with Addendum 1.
B. AMCA 500-L - Laboratory Methods of Testing Louvers for Rating; 2015.
C. AMCA 511 - Certified Ratings Program for Air Control Devices; 2010.
F. ASHRAE Std 130 - Methods of Testing Air Terminal Units; 2016.
P. SMACNA (DCS) - HVAC Duct Construction Standards Metal and Flexible; 2005 (Revised 2009).

1.04  SUBMITTALS
A. See Section 01 3000 - Administrative Requirements for submittal procedures.
B. Product Data: Provide data for equipment required for this project. Review outlets and inlets as to size, finish, and type of mounting prior to submission. Submit schedule of outlets and inlets showing type, size, location, application, and noise level.
C. Samples: Submit two of each required air outlet and inlet type.
D. Project Record Documents: Record actual locations of air outlets and inlets.

1.05  QUALITY ASSURANCE
A. Test and rate air outlet and inlet performance in accordance with ASHRAE Std 70.
B. Test and rate louver performance in accordance with AMCA 500-L.
PART 2 PRODUCTS

2.01 MANUFACTURERS

A. American Louver Company; ALC Grilles and Registers: www.americanlouver.com/#sle.
B. Carnes, a division of Carnes Company Inc; ______: www.carnes.com/#sle.
C. Hart & Cooley, Inc; ______: www.hartandcooley.com/#sle.
D. Krueger-HVAC, Division of Air System Components; ______: www.krueger-hvac.com/#sle.
E. Price Industries; ______: www.price-hvac.com/#sle.
F. Prihoda North America; ______: www.prihoda.com/#sle.
G. Titus, a brand of Air Distribution Technologies; ______: www.titus-hvac.com/#sle.
H. Tuttle and Bailey; ______: www.tuttleandbailey.com/#sle.
I. Substitutions: See Section 01 6000 - Product Requirements.

2.02 RECTANGULAR CEILING DIFFUSERS

A. Type: Provide square, stamped, multi-core, square, adjustable pattern, stamped, multi-core, square and rectangular, multi-louvered, square and rectangular, adjustable pattern, multi-louvered, and ______ diffuser to discharge air in 360 degree, one way, two way, three way, four way, and ______ pattern with sectorizing baffles where indicated.
B. Connections: Round.
C. Frame: Provide surface mount, snap-in, inverted T-bar, spline, and ______ type. In plaster ceilings, provide plaster frame and ceiling frame.
D. Fabrication: Steel with baked enamel finish.
E. Color: As selected by Architect from manufacturer's standard range.
F. Accessories: Provide radial opposed blade, butterfly, combination splitter, and ______ volume control damper; removable core, sectorizing baffle, safety chain, wire guard, equalizing grid, operating rod extension, anti-smudging device, gaskets for surface mounted diffusers, and ______ with damper adjustable from diffuser face.

2.03 CEILING EGG CRATE EXHAUST AND RETURN GRILLES

A. Type: Egg crate style face consisting of 1/2 by 1/2 by 1/2 inch (13 by 13 by 13 mm), 1/2 by 1/2 by 1 inch (13 by 13 by 25 mm), 1 by 1 by 1 inch (25 by 25 by 25 mm), and ______ grid core.
B. Fabrication: Grid core consists of aluminum with mill aluminum finish.
C. Color: To be selected by Architect from manufacturer's standard range.
D. Frame: 1-1/4 inch (32 mm) margin with countersunk screw mounting.
E. Frame: Channel lay-in frame for suspended grid ceilings.
F. Accessories: Provide integral, gang & face operated opposed blade damper, 2 inch filter frame (50 mm filter frame), plaster frame, square mesh insect screen, square mesh debris screen, prescored molded fiberglass back, 45 degree angled eggcrate or other similar provisions for visual blocking such as angled louver, 90 degree duct elbow, etc., and ______.

2.04 WALL SUPPLY REGISTERS/GRILLES

A. Type: Streamlined and individually adjustable blades, 3/4 inch (19 mm) minimum depth, 3/4 inch (19 mm) maximum spacing with spring or other device to set blades, vertical face, single deflection.
B. Frame: 1-1/4 inch (32 mm) margin with countersunk screw mounting and gasket.
C. Fabrication: Steel with 20 gage, 0.0359 inch (0.91 mm) minimum frames and 22 gage, 0.0299 inch (0.76 mm) minimum blades, steel and aluminum with 20 gage, 0.0359 inch (0.91 mm) minimum frame, or aluminum extrusions, with factory baked enamel finish.

D. Color: To be selected by Architect from manufacturer's standard range.

E. Damper: Integral, gang-operated opposed blade type with removable key operator, operable from face.

2.05 WALL EXHAUST AND RETURN REGISTERS/GRILLES

A. Type: Streamlined blades, 3/4 inch (19 mm) minimum depth, 3/4 inch (19 mm) maximum spacing, with spring or other device to set blades, vertical face.

B. Frame: 1-1/4 inch (32 mm) margin with countersunk screw mounting.

C. Fabrication: Steel frames and blades, with factory baked enamel finish.

D. Color: To be selected by Architect from manufacturer's standard range.

E. Damper: Integral, gang-operated, opposed blade type with removable key operator, operable from face.

2.06 LOUVERS

A. Type: 4 inch (100 mm) deep with blades on 45 degree slope with center baffle and return bend, heavy channel frame, 1/2 inch (13 mm) square mesh screen over exhaust and 1/2 inch (13 mm) square mesh screen over intake.

B. Color: To be selected by Architect from manufacturer's standard range.

C. Fabrication: 12 gage, 0.1046 inch (2.66 mm) thick extruded aluminum, welded assembly, with factory prime coat finish.

D. Color: To be selected by Architect from manufacturer's standard range.

E. Mounting: Furnish with interior flat flange for installation.

PART 3 EXECUTION

3.01 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Comply with SMACNA (ASMM) for flashing/counter-flashing of roof penetrations and supports for roof curbs and roof mounted equipment.

C. Check location of outlets and inlets and make necessary adjustments in position to conform with architectural features, symmetry, and lighting arrangement.

D. Install diffusers to ductwork with air tight connection.

E. Provide balancing dampers on duct take-off to diffusers, and grilles and registers, despite whether dampers are specified as part of the diffuser, or grille and register assembly.

F. Paint ductwork visible behind air outlets and inlets matte black. Refer to Section 09 9123.

END OF SECTION
SECTION 23 7433
DEDICATED OUTDOOR AIR UNITS

PART 1 GENERAL

1.01 SECTION INCLUDES
A. Direct fired make-up air heater.
B. Cooling coil section and compressor-condenser unit.
C. Controls.

1.02 RELATED REQUIREMENTS
A. Section 23 0513 - Common Motor Requirements for HVAC Equipment.
B. Section 23 0913 - Instrumentation and Control Devices for HVAC: Control components, time clocks.
C. Section 26 0583 - Wiring Connections: Electrical characteristics and wiring connections.

1.03 REFERENCE STANDARDS
B. AHRI 520 - Performance Rating of Positive Displacement Condensing Units; 2004.

1.04 SUBMITTALS
A. See Section 01 3000 - Administrative Requirements, for submittal procedures.
B. Product Data: Provide data with dimensions, duct and service connections, accessories, controls, electrical nameplate data, and wiring diagrams.
C. Shop Drawings: Indicate dimensions, duct and service connections, accessories, controls, electrical nameplate data, and wiring diagrams.
D. Manufacturer's Instructions: Indicate rigging, assembly, and installation instructions.
E. Sustainable Design Documentation: Submit manufacturer's product data on refrigerant used, showing compliance with specified requirements.
F. Operation And Maintenance Data: Include manufacturer's descriptive literature, operating instructions, installation instructions, maintenance and repair data, and parts listing.
G. Warranty: Submit manufacturers warranty and ensure forms have been filled out in Owner's name and registered with manufacturer.
H. Project Record Documents: Record actual locations of components.
I. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
   1. See Section 01 6000 - Product Requirements, for additional provisions.
   2. Extra Filters: One set of each type and size.

1.05 QUALITY ASSURANCE
A. Manufacturer Qualifications: Company specializing in manufacturing the type of products specified in this section, with minimum three years of documented experience.
1.06 WARRANTY
   A. See Section 01 7800 - Closeout Submittals, for additional warranty requirements.
   B. Provide five year manufacturers warranty for compressor/condenser unit.

PART 2 PRODUCTS
2.01 MANUFACTURERS
   A. Greenheck; _____: www.greenheck.com/#sle.
   B. Addison.
   C. Substitutions: See Section 01 6000 - Product Requirements.

2.02 MANUFACTURED UNITS
   A. Unit: Outdoor dual volume unit with refrigeration package.
      1. Construction and Ratings: In accordance with AHRI 210/240 and UL 207. Testing:
         ASHRAE Std 23.1.
      2. Performance Ratings: Energy Efficiency Rating (EER)/Coefficient of Performance (COP)
         not less than requirements of ASHRAE Std 90.1 I-P.

2.03 FILTERS
   A. Filter: Removable 1 inch (25 mm) thick high velocity permanent filters in metal frames.

2.04 FAN
   A. Fan: Statically and dynamically balanced centrifugal fan mounted on solid steel shaft with heavy
      duty self-aligning pre-lubricated ball bearings and V-belt drive with matching motor sheaves and
      belts.

2.05 CONTROLS
   A. Controls: Pre-wire unit for connection of power supply. Field wiring from unit to remote control
      panel makes unit operative.
   B. Remote Control Panel: On-off-auto switch, summer-winter switch, heat-off-cool switch,
      indicating lights for supply fan, exhaust fan, pilot operation, burner operation, lockout indication,
      and clogged filter indication.

2.06 REFRIGERATION PACKAGE
   A. Evaporator Coil: Copper tube aluminum fin coil assembly with alternate row circuiting, and with
      galvanized drain pan and thermostatic expansion valve.
   B. Compressor: One AHRI 520 hermetic, 3600 rpm maximum resiliently with positive lubrication,
      crankcase heater, high pressure control, low pressure control, motor overload protection,
      service valves and drier.
   C. Condenser: AHRI 520 aluminum fin and copper tube coil, direct drive axial fan resiliently
      mounted, galvanized fan guard.
   D. Operating Controls: Low voltage, adjustable room thermostat controls compressor and
      condenser fan to maintain room temperature setting. Provide hot gas bypass on one
      compressor circuit.
   E. Electrical Characteristics:
      1. Refer to Section 26 0583.
   F. Disconnect Switch: Factory mount disconnect switch in control panel.

PART 3 EXECUTION
3.01 INSTALLATION
   A. Install in accordance with manufacturer's instructions.
3.02 MAINTENANCE

A. Provide service and maintenance of units for one year from Date of Substantial Completion.

END OF SECTION
SECTION 23 8129
VARIABLE REFRIGERANT FLOW HVAC SYSTEMS

PART 1 GENERAL

1.01 SECTION INCLUDES
   A. Variable refrigerant volume HVAC system includes:
      1. Outdoor/condensing unit(s).
      2. Indoor/evaporator units.
      3. Branch selector units.
      4. Refrigerant piping.
      5. Control panels.
      6. Control wiring.

1.02 REFERENCE STANDARDS
   C. ITS (DIR) - Directory of Listed Products; current edition.
   D. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

1.03 SUBMITTALS
   A. See Section 01 3000 - Administrative Requirements, for submittal procedures.
   B. Pre-Bid Submittals: For proposed substitute systems/products, as defined in PART 2, and alternate systems/products, as defined above, proposer shall submit all data described in this article, under the terms given for substitutions stated in PART 2.
   C. Product Data: Submit manufacturer's standard data sheets showing the following for each item of equipment, marked to correlate to equipment item markings indicated in the Contract Documents:
      1. Outdoor/Central Units:
         a. Refrigerant Type and Size of Charge.
         b. Cooling Capacity: Btu/h (W).
         c. Heating Capacity: Btu/h (W).
         d. Cooling Input Power: Btu/h (kW).
         e. Heating Input Power: Btu/h (kW).
         f. Operating Temperature Range, Cooling and Heating.
         g. Air Flow: Cubic feet per minute (Cubic meters per second).
         h. Fan Curves.
         i. External Static Pressure (ESP): Inches WG (Pa).
         j. Sound Pressure Level: dB(A).
         k. Electrical Data:
            1) Maximum Circuit Amps (MCA).
            2) Maximum Fuse Amps (MFA).
            3) Maximum Starting Current (MSC).
            4) Full Load Amps (FLA).
            5) Total Over Current Amps (TOCA).
            6) Fan Motor: HP (W).
         l. Weight and Dimensions.
         m. Maximum number of indoor units that can be served.
         n. Maximum refrigerant piping run from outdoor/condenser unit to indoor/evaporator unit.
o. Maximum height difference between outdoor/condenser unit to indoor/evaporator unit, both above and below.

p. Control Options.

2. Indoor/Evaporator Units:
   b. Heating Capacity: Btu/h (W).
   c. Cooling Input Power: Btu/h (kW).
   d. Heating Input Power: Btu/h (kW).
   e. Air Flow: Cubic feet per minute (Cubic meters per second).
   f. Fan Curves.
   g. External Static Pressure (ESP): Inches WG (Pa).
   h. Sound Pressure level: dB(A).
   i. Electrical Data:
      1) Maximum Circuit Amps (MCA).
      2) Maximum Fuse Amps (MFA).
      3) Maximum Starting Current (MSC).
      4) Full Load Amps (FLA).
      5) Total Over Current Amps (TOCA).
      6) Fan Motor: HP (W).
   j. Maximum Lift of Built-in Condensate Pump.

k. Weight and Dimensions.

l. Control Options.

3. Control Panels: Complete description of options, control points, zones/groups.

1.04 QUALITY ASSURANCE

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Basis of Design: The system design indicated in the Contract Documents is based on equipment and system designed by Daikin AC; www.daikinac.com/#sle.

B. Systems designed and manufactured by other manufacturers will be considered by Owner under the terms described for substitutions with the following exceptions:
   1. Substitution requests will be considered only if received at least 10 days prior to the bid date.
   2. Substitution requests will be considered only if required submittal data is complete; see article SUBMITTALS above.
   3. Contractor (not equipment supplier) shall certify that the use of the substitute system and equipment will not require changes to other work or re-design by Architect.
   4. Do not assume substitution has been accepted until formal written notice has been issued by Architect.

2.02 HVAC SYSTEM DESIGN

A. System Operation: Heating and cooling, simultaneously.
   1. Zoning: Provide capability for temperature control for each individual indoor/evaporator unit independently of all other units.
   2. Zoning: Provide heating/cooling selection for each individual indoor/evaporator unit independently of all other units.
   3. Provide a complete functional system that achieves the specified performance based on the specified design conditions and that is designed and constructed according to the equipment manufacturer's requirements.
   4. Conditioned spaces are indicated on drawings.
   5. Branch selector unit locations are not indicated on drawings.
   6. Required equipment unit capacities are indicated on drawings.
   7. Refrigerant piping sizes are not indicated on drawings.
8. Connect equipment to condensate piping provided by others; condensate piping is indicated on drawings.

B. Cooling Mode Interior Performance:
   1. Daytime Setpoint: 68 degrees F (20 degrees C), plus or minus 2 degrees F (1 degrees C).
   2. Setpoint Range: 57 degrees F (14 degrees C) to 77 degrees F (25 degrees C).
   4. Interior Relative Humidity: 20 percent, maximum.

C. Heating Mode Interior Performance:
   1. Daytime Setpoint: 68 degrees F (20 degrees C), plus or minus 2 degrees F (1 degrees C).
   2. Setpoint Range: 59 degrees F (15 degrees C) to 80 degrees F (27 degrees C).
   4. Interior Relative Humidity: 10 percent, minimum.

D. Outside Air Design Conditions:

E. Energy Design Wind Speed: 25 mph (40 km/h).

F. Operating Temperature Ranges:
   1. Simultaneous Heating and Cooling Operating Range: minus 4 degrees F (minus 20 degrees C) to 60 degrees F (16 degrees C) dry bulb.
   2. Cooling Mode Operating Range: minus 4 degrees F (minus 20 degrees C) to 110 degrees F (43 degrees C) dry bulb.
   3. Heating Mode Operating Range: 0 degrees F (minus 18 degrees C) to 77 degrees F (25 degrees C) dry bulb; minus 4 degrees F (minus 20 degrees C) to 60 degrees F (16 degrees C) wet bulb; without low ambient controls or auxiliary heat source.

G. Refrigerant Piping Lengths: Provide equipment capable of serving system with following piping lengths without any oil traps:
   1. Minimum Piping Length from Outdoor/Central Unit(s) to Furthest Terminal Unit: 540 feet (165 m), actual; 620 feet (189 m), equivalent.
   2. Total Combined Liquid Line Length: 3280 feet (1000 m), minimum.
   3. Minimum Piping Length Between Indoor Units: 49 feet (15 mm).

H. Control Wiring Lengths:
   1. Between Outdoor/Condenser Unit and Indoor/Evaporator Unit: 6,665 feet (2031 m), minimum.
   2. Between Outdoor/Condenser Unit and Central Controller: 3,330 feet (1015 m), minimum.
   3. Between Indoor/Evaporator Unit and Remote Controller: 1,665 feet (507 m).

I. Controls: Provide the following control interfaces:

2.03 EQUIPMENT

A. All Units: Factory assembled, wired, and piped and factory tested for function and safety.
   2. Safety Certification: Tested to UL 1995 by UL or Intertek-ETL, listed in ITS (DIR), and bearing the certification label.
   3. Provide outdoor/condensing units capable of serving indoor unit capacity up to 200 percent of the capacity of the outdoor/condensing unit.
   4. Provide units capable of serving the zones indicated.
   5. Thermal Performance: Provide heating and cooling capacity as indicated, based on the following nominal operating conditions:

B. Electrical Characteristics:
   1. Power - Branch Selector Units: 208 to 230 Volts, single phase, 60 Hz.
   2. Power - Indoor Units: 208 to 230 Volts, single phase, 60 Hz.
C. Refrigerant Piping:
   1. Insulate each refrigerant line individually between the condensing and indoor units.

2.04 OUTDOOR/CONDENSING UNITS

A. Outdoor/Condensing Units: Air-cooled DX refrigeration units, designed specifically for use with indoor/evaporator units; factory assembled and wired with all necessary electronic and refrigerant controls; modular design for ganging multiple units.
   1. Refrigeration Circuit: Scroll compressors, motors, fans, condenser coil, electronic expansion valves, solenoid valves, 4-way valve, distribution headers, capillaries, filters, shut off valves, oil separators, service ports and refrigerant regulator.
   2. Refrigerant: Factory charged.
   3. Variable Volume Control: Modulate compressor capacity automatically to maintain constant suction and condensing pressures while varying refrigerant volume to suit heating/cooling loads.
   4. Capable of being installed with wiring and piping to the left, right, rear or bottom.
   5. Capable of heating operation at low end of operating range as specified, without additional low ambient controls or auxiliary heat source; during heating operation, reverse cycle (cooling mode) oil return or defrost is not permitted, due to potential reduction in space temperature.
   6. Sound Pressure Level: As specified, measured at 3 feet (one meter) from front of unit; provide night setback sound control as a standard feature; three selectable sound level steps of 55 dB, 50 dB, and 45 dB, maximum.
   7. Power Failure Mode: Automatically restart operation after power failure without loss of programmed settings.
   8. Safety Devices: High pressure sensor and switch, low pressure sensor/switch, control circuit fuses, crankcase heaters, fusible plug, overload relay, inverter overload protector, thermal protectors for compressor and fan motors, over current protection for the inverter and anti-recycling timers.
   9. Provide refrigerant sub-cooling to ensure the liquid refrigerant does not flash when supplying to us indoor units.
  10. Oil Recovery Cycle: Automatic, occurring 2 hours after start of operation and then every 8 hours of operation; maintain continuous heating during oil return operation.
  11. Controls: Provide contacts for electrical demand shedding.

B. Unit Cabinet: Weatherproof and corrosion resistant; rust-proofed mild steel panels coated with baked enamel finish.
   1. Designed to allow side-by-side installation with minimum spacing.

C. Fans: One or more direct-drive propeller type, vertical discharge, with multiple speed operation via DC (digitally commutating) inverter.
   1. Provide minimum of 2 fans for each condensing unit.
   2. External Static Pressure: Factory set at 0.12 in WG (30 Pa), minimum.
   3. Indoor Mounted Air-Cooled Units: External static pressure field set at 0.32 in WG (80 Pa), minimum; provide for mounting of field-installed ducts.
   4. Fan Airflow: As indicated for specific equipment.
   5. Fan Motors: Factory installed; permanently lubricated bearings; inherent protection; fan guard; output as indicated for specific equipment.

D. Condenser Coils: Copper tubes expanded into aluminum fins to form mechanical bond; waffle louver fin and rifled bore tube design to ensure high efficiency performance.

E. Compressors: Scroll type, hermetically sealed, variable speed inverter-driven and fixed speed in combination to suit total capacity; minimum of one variable speed, inverter driven compressor per condenser unit; minimum of two compressors per condenser unit; capable of controlling capacity within range of 6 percent to 100 percent of total capacity.
   1. Multiple Condenser Modules: Balance total operation hours of compressors by means of duty cycling function, providing for sequential starting of each module at each start/stop cycle, completion of oil return, and completion of defrost, or every 8 hours.
2. Failure Mode: In the event of compressor failure, operate remaining compressor(s) at proportionally reduced capacity; provide microprocessor and associated controls specifically designed to address this condition.
3. Provide each compressor with crankcase heater, high pressure safety switch, and internal thermal overload protector.
4. Provide oil separators and intelligent oil management system.
5. Provide spring mounted vibration isolators.

2.05 BRANCH SELECTOR UNITS
A. Branch Selector Units: Concealed boxes designed specifically for this type of system to control heating/cooling mode selection of downstream units; consisting of electronic expansion valves, subcooling heat exchanger, refrigerant control piping and electronics to facilitate communications between unit and main processor and between branch unit and indoor/evaporator units.
   1. Control direction of refrigerant flow using electronic expansion valves; use of solenoid valves for changeover and pressure equalization is not permitted due to refrigerant noise; use of multi-port branch selector boxes is not permitted unless spare ports are provided for redundancy.
   2. Provide one electronic expansion valve for each downstream unit served, except multiple indoor/evaporator units may be connected, provided balancing joints are used in downstream piping and total capacity is within capacity range of the branch selector.
   3. When branch unit is simultaneously heating and cooling, energize subcooling heat exchanger.
   4. Casing: Galvanized steel sheet; with flame and heat resistant foamed polyethylene sound and thermal insulation.
   5. Refrigerant Connections: Braze type.
   6. Condensate Drainage: Provide unit that does not require condensate drainage.

2.06 INDOOR/EVAPORATOR UNITS
A. All Indoor/Evaporator Units: Factory assembled and tested DX fan-coil units, with electronic proportional expansion valve, control circuit board, factory wiring and piping, self-diagnostics, auto-restart function, 3-minute fused time delay, and test run switch.
   1. Refrigerant: Refrigerant circuits factory-charged with dehydrated air, for field charging.
   2. Temperature Control Mechanism: Return air thermistor and computerized Proportional-Integral-Derivative (PID) control of superheat.
   3. Coils: Direct expansion type constructed from copper tubes expanded into aluminum fins to form a mechanical bond; waffle louver fin and high heat exchange, rifled bore tube design; factory tested.
      a. Provide thermistor on liquid and gas lines.
   4. Fans: Direct-drive, with statically and dynamically balanced impellers; high and low speeds unless otherwise indicated; motor thermally protected.
   5. Return Air Filter: Washable long-life net filter with mildew proof resin, unless otherwise indicated.
   7. Cabinet Insulation: Sound absorbing foamed polystyrene and polyethylene insulation.
B. Recessed Ceiling Units - 3 FT by 3 FT: Four-way airflow cassette with central return air grille, for installation in a fixed ceiling.
   1. Face Size: 33 inches (939 mm) square, nominal.
   2. Cabinet Height: Maximum of 10 inches (250 mm) above face of ceiling.
   3. Exposed Housing: White, impact resistant, with washable decoration panel.
   4. Supply Airflow Adjustment:
      a. Via motorized louvers which can be horizontally and vertically adjusted from 0 to 90 degrees.
      b. Field-modifiable to 3-way and 2-way airflow.
c. Three auto-swing positions, including standard, draft prevention and ceiling stain prevention.
5. Return Air Filter: Manufacturer's standard.
6. Minimum Capacity: As indicated on drawings.
7. Sound Pressure Range: Between 28 dB(A) to 33 dB(A) at low speed measured at 5 feet (1.5 m) below the unit.
8. Fan: Direct-drive turbo type, with motor output range of 0.06 to 0.12 HP (45 to 90 W).
9. Condensate Pump: Built-in, with lift of 21 inches (533 mm), minimum.
10. Provide side-mounted supply air branch duct connection.
11. Provide side-mounted fresh air intake duct connection.

C. Recessed Ceiling Units - 2 FT by 2 FT: Four-way airflow cassette with central return air grille, sized for installation in standard 24 by 24 inch (610 by 610 mm) lay-in ceiling grid.
1. Cabinet Height: Maximum of 12 inches (305 mm) above face of ceiling.
2. Exposed Housing: White, impact resistant, with washable decoration panel.
4. Supply Airflow Adjustment:
   a. Via motorized louvers which can be horizontally and vertically adjusted from 0 to 90 degrees.
   b. Field-modifiable to 3-way and 2-way airflow.
   c. Three auto-swing positions, including standard, draft prevention and ceiling stain prevention.
5. Sound Pressure: Measured at low speed at 5 feet (1.5 m) below unit.
6. Fan: Direct-drive turbo type.
7. Condensate Pump: Built-in, with lift of 21 inches (533 mm), minimum.
8. Provide side-mounted supply air branch duct connection.
9. Provide side-mounted fresh air intake duct connection.

D. Concealed-In-Ceiling Units: Ducted horizontal discharge and return; galvanized steel cabinet.
1. Return Air Filter: Manufacturer's standard.
2. Sound Pressure: Measured at low speed at 5 feet (1.5 m) below unit.
3. Provide external static pressure switch adjustable for high efficiency filter operation
4. Condensate Pump: Built-in, with lift of 9 inches (229 mm), minimum.
5. Switch box accessible from side or bottom.

PART 3 EXECUTION

3.01 EXAMINATION
   A. Verify that required electrical services have been installed and are in the proper locations prior to starting installation.
   B. Verify that condensate piping has been installed and is in the proper location prior to starting installation.
   C. Notify Architect if conditions for installation are unsatisfactory.

3.02 INSTALLATION
   A. Install in accordance with manufacturer's instructions.
   B. Install refrigerant piping in accordance with equipment manufacturer's instructions.
   C. Perform wiring in accordance with NFPA 70, National Electric Code (NEC).
   D. Coordinate with installers of systems and equipment connecting to this system.

3.03 SYSTEM STARTUP
   A. Prepare and start equipment and system in accordance with manufacturer's instructions and recommendations.
   B. Adjust equipment for proper operation within manufacturer's published tolerances.

END OF SECTION
SECTION 26 0519
LOW-VOLTAGE ELECTRICAL POWER CONDUCTORS AND CABLES

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Single conductor building wire.
B. Underground feeder and branch-circuit cable.
C. Service entrance cable.
D. Armored cable.
E. Metal-clad cable.
F. Wiring connectors.
G. Electrical tape.
H. Heat shrink tubing.
I. Oxide inhibiting compound.
J. Wire pulling lubricant.
K. Cable ties.

1.02 RELATED REQUIREMENTS

A. Section 07 8400 - Firestopping.
B. Section 26 0526 - Grounding and Bonding for Electrical Systems: Additional requirements for grounding conductors and grounding connectors.
C. Section 26 0553 - Identification for Electrical Systems: Identification products and requirements.
D. Section 26 2100 - Low-Voltage Electrical Service Entrance: Additional requirements for electrical service conductors.
E. Section 28 4600 - Fire Detection and Alarm: Fire alarm system conductors and cables.

1.03 REFERENCE STANDARDS

I. NECA 1 - Standard for Good Workmanship in Electrical Construction; 2015.
J. NECA 104 - Recommended Practice for Installing Aluminum Building Wire and Cable; 2012.
K. NECA 120 - Standard for Installing Armored Cable (AC) and Metal-Clad Cable (MC); 2012.
N. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.
O. UL 4 - Armored Cable; Current Edition, Including All Revisions.
P. UL 44 - Thermoset-Insulated Wires and Cables; Current Edition, Including All Revisions.
S. UL 486C - Splicing Wire Connectors; Current Edition, Including All Revisions.
U. UL 510 - Polyvinyl Chloride, Polyethylene, and Rubber Insulating Tape; Current Edition, Including All Revisions.
V. UL 1569 - Metal-Clad Cables; Current Edition, Including All Revisions.

1.04 ADMINISTRATIVE REQUIREMENTS

A. Coordination:
   1. Coordinate sizes of raceways, boxes, and equipment enclosures installed under other sections with the actual conductors to be installed, including adjustments for conductor sizes increased for voltage drop.
   2. Coordinate the installation of direct burial cable with other trades to avoid conflicts with piping or other potential conflicts.
   3. Coordinate with electrical equipment installed under other sections to provide terminations suitable for use with the conductors to be installed.
   4. Notify Architect of any conflicts with or deviations from the contract documents. Obtain direction before proceeding with work.

1.05 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.
B. Product Data: Provide manufacturer's standard catalog pages and data sheets for conductors and cables, including detailed information on materials, construction, ratings, listings, and available sizes, configurations, and stranding.
C. Project Record Documents: Record actual installed circuiting arrangements. Record actual routing for underground circuits.

1.06 QUALITY ASSURANCE

A. Conform to requirements of NFPA 70.
B. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years documented experience.
C. Product Listing Organization Qualifications: An organization recognized by OSHA as a Nationally Recognized Testing Laboratory (NRTL) and acceptable to authorities having jurisdiction.

1.07 DELIVERY, STORAGE, AND HANDLING

A. Receive, inspect, handle, and store conductors and cables in accordance with manufacturer's instructions.

1.08 FIELD CONDITIONS

A. Do not install or otherwise handle thermoplastic-insulated conductors at temperatures lower than 14 degrees F (-10 degrees C), unless otherwise permitted by manufacturer's instructions.
When installation below this temperature is unavoidable, notify Architect and obtain direction before proceeding with work.

**PART 2 PRODUCTS**

### 2.01 CONDUCTOR AND CABLE APPLICATIONS

A. Do not use conductors and cables for applications other than as permitted by NFPA 70 and product listing.

B. Provide single conductor building wire installed in suitable raceway unless otherwise indicated, permitted, or required.

C. Nonmetallic-sheathed cable is not permitted.

D. Underground feeder and branch-circuit cable is not permitted.

E. Service entrance cable is not permitted.

### 2.02 CONDUCTOR AND CABLE GENERAL REQUIREMENTS

A. Provide products that comply with requirements of NFPA 70.

B. Provide products listed, classified, and labeled as suitable for the purpose intended.

C. Unless specifically indicated to be excluded, provide all required conduit, boxes, wiring, connectors, etc. as required for a complete operating system.

D. Comply with NEMA WC 70.

E. Thermoplastic-Insulated Conductors and Cables: Listed and labeled as complying with UL 83.

F. Thermoset-Insulated Conductors and Cables: Listed and labeled as complying with UL 44.

G. Conductors for Grounding and Bonding: Also comply with Section 26 0526.

H. Conductor Material:
   1. Provide copper conductors except where aluminum conductors are specifically indicated or permitted for substitution. Conductor sizes indicated are based on copper unless specifically indicated as aluminum. Conductors designated with the abbreviation "AL" indicate aluminum.
      a. Substitution of aluminum conductors for copper is permitted, when approved by Owner and authority having jurisdiction, only for the following:
         1) Services: Copper conductors size 1/0 AWG and larger.
         2) Feeders: Copper conductors size 1/0 AWG and larger.
      b. Where aluminum conductors are substituted for copper, comply with the following:
         1) Size aluminum conductors to provide, when compared to copper sizes indicated, equivalent or greater ampacity and equivalent or less voltage drop.
         2) Increase size of raceways, boxes, wiring gutters, enclosures, etc. as required to accommodate aluminum conductors.
         3) Equip electrical distribution equipment with compression lugs for terminating aluminum conductors.

2. Copper Conductors: Soft drawn annealed, 98 percent conductivity, uncoated copper conductors complying with ASTM B3, ASTM B8, or ASTM B787/B787M unless otherwise indicated.

3. Tinned Copper Conductors: Comply with ASTM B33.

4. Aluminum Conductors (only where specifically indicated or permitted for substitution):
   AA-8000 series aluminum alloy conductors recognized by ASTM B800 and compact stranded in accordance with ASTM B801 unless otherwise indicated.

I. Minimum Conductor Size:
   1. Branch Circuits: 12 AWG.
      a. Exceptions:
         1) 20 A, 120 V circuits longer than 75 feet (23 m): 10 AWG, for voltage drop.
         2) 20 A, 120 V circuits longer than 150 feet (46 m): 8 AWG, for voltage drop.
         3) 20 A, 277 V circuits longer than 150 feet (46 m): 10 AWG, for voltage drop.
2. Control Circuits: 14 AWG.

J. Where conductor size is not indicated, size to comply with NFPA 70 but not less than applicable minimum size requirements specified.

K. Conductor Color Coding:
   1. Color code conductors as indicated unless otherwise required by the authority having jurisdiction. Maintain consistent color coding throughout project.
   2. Color Coding Method: Integrally colored insulation.
      a. Conductors size 4 AWG and larger may have black insulation color coded using vinyl color coding electrical tape.
   3. Color Code:
      a. 480Y/277 V, 3 Phase, 4 Wire System:
         1) Phase A: Brown.
         2) Phase B: Orange.
         3) Phase C: Yellow.
         4) Neutral/Grounded: Gray.
      b. 208Y/120 V, 3 Phase, 4 Wire System:
         1) Phase A: Black.
         2) Phase B: Red.
         3) Phase C: Blue.
         4) Neutral/Grounded: White.
      c. Equipment Ground, All Systems: Green.
      d. Travelers for 3-Way and 4-Way Switching: Pink.

2.03 SINGLE CONDUCTOR BUILDING WIRE

A. Manufacturers:
   1. Copper Building Wire:
      c. General Cable Technologies Corporation; ______:  www.generalcable.com/#sle.
      e. Substitutions: See Section 01 6000 - Product Requirements.
   2. Aluminum Building Wire (only where specifically indicated or permitted for substitution):
      c. Stabiloy, a brand of General Cable Technologies Corporation; ______:  www.stabiloy.com/#sle.
      d. Substitutions: See Section 01 6000 - Product Requirements.

B. Description: Single conductor insulated wire.

C. Conductor Stranding:
   1. Feeders and Branch Circuits:
      b. Size 8 AWG and Larger: Stranded.
   2. Control Circuits: Stranded.

D. Insulation Voltage Rating: 600 V.

E. Insulation:
   1. Copper Building Wire: Type THHN/THWN or THHN/THWN-2, except as indicated below.
      b. Fixture Wiring Within Luminaires: Type TFFN/TFN for luminaires with labeled maximum temperature of 90 degrees C; Approved suitable type for luminaires with labeled maximum temperature greater than 90 degrees C.
   2. Aluminum Building Wire (only where specifically indicated or permitted for substitution): Type XHHW-2.
2.04 ARMORED CABLE

A. Manufacturers:
   1. AFC Cable Systems Inc: www.afcweb.com/#sle.
   4. Substitutions: See Section 01 6000 - Product Requirements.

B. Description: NFPA 70, Type AC cable listed and labeled as complying with UL 4, and listed for use in classified firestop systems to be used.

C. Conductor Stranding:
   2. Size 8 AWG and Larger: Stranded.

D. Insulation Voltage Rating: 600 V.

E. Insulation: Type THHN.

F. Grounding: Combination of interlocking armor and integral bonding wire.

G. Armor: Steel, interlocked tape.

2.05 METAL-CLAD CABLE

A. Manufacturers:
   1. AFC Cable Systems Inc: www.afcweb.com/#sle.
   4. Substitutions: See Section 01 6000 - Product Requirements.

B. Description: NFPA 70, Type MC cable listed and labeled as complying with UL 1569, and listed for use in classified firestop systems to be used.

C. Conductor Stranding:
   2. Size 8 AWG and Larger: Stranded.

D. Insulation Voltage Rating: 600 V.

E. Insulation: Type THHN, THHN/THWN, or THHN/THWN-2.

F. Grounding: Full-size integral equipment grounding conductor.

G. Armor: Steel, interlocked tape.

H. Provide PVC jacket applied over cable armor where indicated or required for environment of installed location.

2.06 WIRING CONNECTORS

A. Description: Wiring connectors appropriate for the application, suitable for use with the conductors to be connected, and listed as complying with UL 486A-486B or UL 486C as applicable.

B. Connectors for Grounding and Bonding: Comply with Section 26 0526.

C. Wiring Connectors for Splices and Taps:
   1. Copper Conductors Size 8 AWG and Smaller: Use twist-on insulated spring connectors.
   2. Copper Conductors Size 6 AWG and Larger: Use mechanical connectors or compression connectors.

D. Wiring Connectors for Terminations:
   1. Provide terminal lugs for connecting conductors to equipment furnished with terminations designed for terminal lugs.
   2. Provide compression adapters for connecting conductors to equipment furnished with mechanical lugs when only compression connectors are specified.
3. Where over-sized conductors are larger than the equipment terminations can accommodate, provide connectors suitable for reducing to appropriate size, but not less than required for the rating of the overcurrent protective device.

4. Provide motor pigtail connectors for connecting motor leads in order to facilitate disconnection.

5. Copper Conductors Size 8 AWG and Larger: Use mechanical connectors or compression connectors where connectors are required.

6. Aluminum Conductors: Use compression connectors for all connections.

7. Stranded Conductors Size 10 AWG and Smaller: Use crimped terminals for connections to terminal screws.

8. Conductors for Control Circuits: Use crimped terminals for all connections.

E. Do not use insulation-piercing or insulation-displacement connectors designed for use with conductors without stripping insulation.

F. Do not use push-in wire connectors as a substitute for twist-on insulated spring connectors.

G. Twist-on Insulated Spring Connectors: Rated 600 V, 221 degrees F (105 degrees C) for standard applications and 302 degrees F (150 degrees C) for high temperature applications; pre-filled with sealant and listed as complying with UL 486D for damp and wet locations.

1. Manufactures:
   a. 3M: www.3m.com/#sle.
   c. NSI Industries LLC: www.nsiindustries.com/#sle.
   d. Substitutions: See Section 01 6000 - Product Requirements.

H. Mechanical Connectors: Provide bolted type or set-screw type.

1. Manufactures:
   d. Substitutions: See Section 01 6000 - Product Requirements.

I. Compression Connectors: Provide circumferential type or hex type crimp configuration.

1. Manufactures:
   d. Substitutions: See Section 01 6000 - Product Requirements.

J. Crimped Terminals: Nylon-insulated, with insulation grip and terminal configuration suitable for connection to be made.

1. Manufactures:
   d. Substitutions: See Section 01 6000 - Product Requirements.

2.07 WIRING ACCESSORIES

A. Electrical Tape:

1. Manufactures:
   a. 3M: www.3m.com/#sle.

2. Vinyl Color Coding Electrical Tape: Integral colored to match color code indicated; listed as complying with UL 510; minimum thickness of 7 mil (0.18 mm); resistant to abrasion, corrosion, and sunlight; suitable for continuous temperature environment up to 221 degrees F (105 degrees C).

3. Vinyl Insulating Electrical Tape: Complying with ASTM D3005 and listed as complying with UL 510; minimum thickness of 7 mil (0.18 mm); resistant to abrasion, corrosion, and...
sunlight; conformable for application down to 0 degrees F (-18 degrees C) and suitable for 
continuous temperature environment up to 221 degrees F (105 degrees C).

4. Rubber Splicing Electrical Tape: Ethylene Propylene Rubber (EPR) tape, complying with 
ASTM D4388; minimum thickness of 30 mil (0.76 mm); suitable for continuous 
temperature environment up to 194 degrees F (90 degrees C) and short-term 266 degrees 
F (130 degrees C) overload service.

5. Electrical Filler Tape: Rubber-based insulating moldable putty, minimum thickness of 125 
mil (3.2 mm); suitable for continuous temperature environment up to 176 degrees F (80 
degrees C).

6. Moisture Sealing Electrical Tape: Insulating mastic compound laminated to flexible, 
all-weather vinyl backing; minimum thickness of 90 mil (2.3 mm).

B. Heat Shrink Tubing: Heavy-wall, split-resistant, with factory-applied adhesive; rated 600 V; 
suitable for direct burial applications; listed as complying with UL 486D.

C. Oxide Inhibiting Compound: Listed; suitable for use with the conductors or cables to be 
installed.

D. Wire Pulling Lubricant: Listed; suitable for use with the conductors or cables to be installed 
and suitable for use at the installation temperature.

1. Manufacturers:
   a. 3M: www.3m.com/#sle.
   d. Substitutions: See Section 01 6000 - Product Requirements.

E. Cable Ties: Material and tensile strength rating suitable for application.

1. Manufacturers:
   b. Substitutions: See Section 01 6000 - Product Requirements.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that interior of building has been protected from weather.

B. Verify that work likely to damage wire and cable has been completed.

C. Verify that raceways, boxes, and equipment enclosures are installed and are properly sized to 
accommodate conductors and cables in accordance with NFPA 70.

D. Verify that field measurements are as indicated.

E. Verify that conditions are satisfactory for installation prior to starting work.

3.02 PREPARATION

A. Clean raceways thoroughly to remove foreign materials before installing conductors and cables.

3.03 INSTALLATION

A. Circuiting Requirements:
   1. Unless dimensioned, circuit routing indicated is diagrammatic.
   2. When circuit destination is indicated without specific routing, determine exact routing 
required.
   3. Arrange circuiting to minimize splices.
   4. Include circuit lengths required to install connected devices within 10 ft (3.0 m) of location 
indicated.
   5. Maintain separation of wiring for emergency systems in accordance with NFPA 70.
   6. Common Neutrals: Unless otherwise indicated, sharing of neutral/grounded conductors 
among up to three single phase branch circuits of different phases installed in the same 
raceway is not permitted. Provide dedicated neutral/grounded conductor for each individual 
branch circuit.

B. Install products in accordance with manufacturer’s instructions.
C. Perform work in accordance with NECA 1 (general workmanship).
D. Install aluminum conductors in accordance with NECA 104.
E. Install armored cable (Type AC) in accordance with NECA 120.
F. Install metal-clad cable (Type MC) in accordance with NECA 120.
G. Installation in Raceway:
   1. Tape ends of conductors and cables to prevent infiltration of moisture and other contaminants.
   2. Pull all conductors and cables together into raceway at same time.
   3. Do not damage conductors and cables or exceed manufacturer's recommended maximum pulling tension and sidewall pressure.
   4. Use suitable wire pulling lubricant where necessary, except when lubricant is not recommended by the manufacturer.
H. Paralleled Conductors: Install conductors of the same length and terminate in the same manner.
I. Secure and support conductors and cables in accordance with NFPA 70 using suitable supports and methods approved by the authority having jurisdiction. Provide independent support from building structure. Do not provide support from raceways, piping, ductwork, or other systems.
   1. Installation Above Suspended Ceilings: Do not provide support from ceiling support system. Do not provide support from ceiling grid or allow conductors and cables to lay on ceiling tiles.
J. Terminate cables using suitable fittings.
   1. Armored Cable (Type AC):
      a. Use listed fittings and anti-short, insulating bushings.
      b. Cut cable armor only using specialized tools to prevent damaging conductors or insulation. Do not use hacksaw or wire cutters to cut armor.
   2. Metal-Clad Cable (Type MC):
      a. Use listed fittings.
      b. Cut cable armor only using specialized tools to prevent damaging conductors or insulation. Do not use hacksaw or wire cutters to cut armor.
K. Install conductors with a minimum of 12 inches (300 mm) of slack at each outlet.
L. Where conductors are installed in enclosures for future termination by others, provide a minimum of 5 feet (1.5 m) of slack.
M. Neatly train and bundle conductors inside boxes, wireways, panelboards and other equipment enclosures.
N. Group or otherwise identify neutral/grounded conductors with associated ungrounded conductors inside enclosures in accordance with NFPA 70.
O. Make wiring connections using specified wiring connectors.
   1. Make splices and taps only in accessible boxes. Do not pull splices into raceways or make splices in conduit bodies or wiring gutters.
   2. Remove appropriate amount of conductor insulation for making connections without cutting, nicking or damaging conductors.
   3. Do not remove conductor strands to facilitate insertion into connector.
   4. Clean contact surfaces on conductors and connectors to suitable remove corrosion, oxides, and other contaminates. Do not use wire brush on plated connector surfaces.
   5. Connections for Aluminum Conductors: Fill connectors with oxide inhibiting compound where not pre-filled by manufacturer.
   6. Mechanical Connectors: Secure connections according to manufacturer's recommended torque settings.
7. Compression Connectors: Secure connections using manufacturer’s recommended tools and dies.

P. Insulate splices and taps that are made with uninsulated connectors using methods suitable for the application, with insulation and mechanical strength at least equivalent to unspliced conductors.
   1. Dry Locations: Use insulating covers specifically designed for the connectors, electrical tape, or heat shrink tubing.
      a. For taped connections, first apply adequate amount of rubber splicing electrical tape or electrical filler tape, followed by outer covering of vinyl insulating electrical tape.
   2. Damp Locations: Use insulating covers specifically designed for the connectors, electrical tape, or heat shrink tubing.
      a. For connections with insulating covers, apply outer covering of moisture sealing electrical tape.
      b. For taped connections, follow same procedure as for dry locations but apply outer covering of moisture sealing electrical tape.

Q. Insulate ends of spare conductors using vinyl insulating electrical tape.

R. Field-Applied Color Coding: Where vinyl color coding electrical tape is used in lieu of integrally colored insulation as permitted in Part 2 under "Color Coding", apply half overlapping turns of tape at each termination and at each location conductors are accessible.

S. Identify conductors and cables in accordance with Section 26 0553.

T. Unless specifically indicated to be excluded, provide final connections to all equipment and devices, including those furnished by others, as required for a complete operating system.

3.04 FIELD QUALITY CONTROL
   A. See Section 01 4000 - Quality Requirements, for additional requirements.
   B. Inspect and test in accordance with NETA ATS, except Section 4.
   C. Perform inspections and tests listed in NETA ATS, Section 7.3.2. The insulation resistance test is required for all conductors. The resistance test for parallel conductors listed as optional is not required.
      1. Disconnect surge protective devices (SPDs) prior to performing any high potential testing. Replace SPDs damaged by performing high potential testing with SPDs connected.
   D. Correct deficiencies and replace damaged or defective conductors and cables.

END OF SECTION
SECTION 26 0526
GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS

PART 1  GENERAL

1.01  SECTION INCLUDES
A. Grounding and bonding requirements.
B. Conductors for grounding and bonding.
C. Connectors for grounding and bonding.
D. Ground bars.
E. Ground rod electrodes.

1.02  RELATED REQUIREMENTS
A. Section 26 0519 - Low-Voltage Electrical Power Conductors and Cables: Additional requirements for conductors for grounding and bonding, including conductor color coding.
B. Section 26 0553 - Identification for Electrical Systems: Identification products and requirements.

1.03  REFERENCE STANDARDS
A. NECA 1 - Standard for Good Workmanship in Electrical Construction; 2015.
D. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.
E. UL 467 - Grounding and Bonding Equipment; Current Edition, Including All Revisions.

1.04  ADMINISTRATIVE REQUIREMENTS
A. Coordination:
   1. Verify exact locations of underground metal water service pipe entrances to building.
   2. Coordinate the work with other trades to provide steel reinforcement complying with specified requirements for concrete-encased electrode.
   3. Notify Architect of any conflicts with or deviations from the contract documents. Obtain direction before proceeding with work.
B. Sequencing:
   1. Do not install ground rod electrodes until final backfill and compaction is complete.

1.05  SUBMITTALS
A. See Section 01 3000 - Administrative Requirements for submittals procedures.
B. Product Data: Provide manufacturer's standard catalog pages and data sheets for grounding and bonding system components.
C. Manufacturer’s Instructions: Indicate application conditions and limitations of use stipulated by product testing agency. Include instructions for storage, handling, protection, examination, preparation, and installation of product.
D. Field quality control test reports.

1.06  QUALITY ASSURANCE
A. Conform to requirements of NFPA 70.
B. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years documented experience.
C. Installer Qualifications for Signal Reference Grids: Company with minimum five years documented experience with high frequency grounding systems.
D. Product Listing Organization Qualifications: An organization recognized by OSHA as a Nationally Recognized Testing Laboratory (NRTL) and acceptable to authorities having jurisdiction.

1.07 DELIVERY, STORAGE, AND HANDLING
A. Receive, inspect, handle, and store products in accordance with manufacturer’s instructions.

PART 2 PRODUCTS

2.01 GROUNDING AND BONDING REQUIREMENTS

A. Existing Work: Where existing grounding and bonding system components are indicated to be reused, they may be reused only where they are free from corrosion, integrity and continuity are verified, and where acceptable to the authority having jurisdiction.

B. Do not use products for applications other than as permitted by NFPA 70 and product listing.

C. Unless specifically indicated to be excluded, provide all required components, conductors, connectors, conduit, boxes, fittings, supports, accessories, etc. as necessary for a complete grounding and bonding system.

D. Where conductor size is not indicated, size to comply with NFPA 70 but not less than applicable minimum size requirements specified.

E. Grounding System Resistance:
   1. Achieve specified grounding system resistance under normally dry conditions unless otherwise approved by Architect. Precipitation within the previous 48 hours does not constitute normally dry conditions.

F. Grounding Electrode System:
   1. Provide connection to required and supplemental grounding electrodes indicated to form grounding electrode system.
      a. Provide continuous grounding electrode conductors without splice or joint.
      b. Install grounding electrode conductors in raceway where exposed to physical damage. Bond grounding electrode conductor to metallic raceways at each end with bonding jumper.
   2. Metal Underground Water Pipe(s):
      a. Provide connection to underground metal domestic and fire protection (where present) water service pipe(s) that are in direct contact with earth for at least 10 feet (3.0 m) at an accessible location not more than 5 feet (1.5 m) from the point of entrance to the building.
      b. Provide bonding jumper(s) around insulating joints/pipes as required to make pipe electrically continuous.
      c. Provide bonding jumper around water meter of sufficient length to permit removal of meter without disconnecting jumper.
   3. Concrete-Encased Electrode:
      a. Provide connection to concrete-encased electrode consisting of not less than 20 feet (6.0 m) of either steel reinforcing bars or bare copper conductor not smaller than 4 AWG embedded within concrete foundation or footing that is in direct contact with earth in accordance with NFPA 70.
   4. Ground Rod Electrode(s):
      a. Provide three electrodes in an equilateral triangle configuration unless otherwise indicated or required.
      b. Space electrodes not less than 10 feet (3.0 m) from each other and any other ground electrode.
   5. Provide additional ground electrode(s) as required to achieve specified grounding electrode system resistance.
   6. Ground Bar: Provide ground bar, separate from service equipment enclosure, for common connection point of grounding electrode system bonding jumpers as permitted in NFPA 70. Connect grounding electrode conductor provided for service-supplied system grounding to this ground bar.
a. Ground Bar Size: 1/4 by 2 by 12 inches (6 by 50 by 300 mm) unless otherwise indicated or required.
b. Where ground bar location is not indicated, locate in accessible location as near as possible to service disconnect enclosure.
c. Ground Bar Mounting Height: 18 inches (450 mm) above finished floor unless otherwise indicated.

7. Ground Riser: Provide common grounding electrode conductor not less than 3/0 AWG for tap connections to multiple separately derived systems as permitted in NFPA 70.

G. Service-Supplied System Grounding:
1. For each service disconnect, provide grounding electrode conductor to connect neutral (grounded) service conductor to grounding electrode system. Unless otherwise indicated, make connection at neutral (grounded) bus in service disconnect enclosure.
2. For each service disconnect, provide main bonding jumper to connect neutral (grounded) bus to equipment ground bus where not factory-installed. Do not make any other connections between neutral (grounded) conductors and ground on load side of service disconnect.

H. Separately Derived System Grounding:
1. Separately derived systems include, but are not limited to:
   a. Transformers (except autotransformers such as buck-boost transformers).
2. Provide grounding electrode conductor to connect derived system grounded conductor to nearest effectively grounded metal building frame. Unless otherwise indicated, make connection at neutral (grounded) bus in source enclosure.
3. Provide bonding jumper to connect derived system grounded conductor to nearest metal building frame and nearest metal water piping in the area served by the derived system, where not already used as a grounding electrode for the derived system. Make connection at same location as grounding electrode conductor connection.
4. Where common grounding electrode conductor ground riser is used for tap connections to multiple separately derived systems, provide bonding jumper to connect the metal building frame and metal water piping in the area served by the derived system to the common grounding electrode conductor.
5. Provide system bonding jumper to connect system grounded conductor to equipment ground bus. Make connection at same location as grounding electrode conductor connection. Do not make any other connections between neutral (grounded) conductors and ground on load side of separately derived system disconnect.
6. Where the source and first disconnecting means are in separate enclosures, provide supply-side bonding jumper between source and first disconnecting means.

I. Bonding and Equipment Grounding:
1. Provide bonding for equipment grounding conductors, equipment ground busses, metallic equipment enclosures, metallic raceways and boxes, device grounding terminals, and other normally non-current-carrying conductive materials enclosing electrical conductors/equipment or likely to become energized as indicated and in accordance with NFPA 70.
2. Provide insulated equipment grounding conductor in each feeder and branch circuit raceway. Do not use raceways as sole equipment grounding conductor.
3. Where circuit conductor sizes are increased for voltage drop, increase size of equipment grounding conductor proportionally in accordance with NFPA 70.
4. Unless otherwise indicated, connect wiring device grounding terminal to branch circuit equipment grounding conductor and to outlet box with bonding jumper.
5. Terminate branch circuit equipment grounding conductors on solidly bonded equipment ground bus only. Do not terminate on neutral (grounded) or isolated/insulated ground bus.
6. Provide bonding jumper across expansion or expansion/deflection fittings provided to accommodate conduit movement.
7. Provide bonding for interior metal piping systems in accordance with NFPA 70. This includes, but is not limited to:
a. Metal water piping where not already effectively bonded to metal underground water pipe used as grounding electrode.

8. Provide bonding for metal building frame.

J. Communications Systems Grounding and Bonding:
   1. Provide intersystem bonding termination at service equipment or metering equipment enclosure and at disconnecting means for any additional buildings or structures in accordance with NFPA 70.
   2. Provide bonding jumper in raceway from intersystem bonding termination to each communications room or backboard and provide ground bar for termination.
      a. Bonding Jumper Size: 6 AWG, unless otherwise indicated or required.
      b. Raceway Size: 3/4 inch (21 mm) trade size unless otherwise indicated or required.
      c. Ground Bar Size: 1/4 by 2 by 12 inches (6 by 50 by 300 mm) unless otherwise indicated or required.
      d. Ground Bar Mounting Height: 18 inches (450 mm) above finished floor unless otherwise indicated.

2.02 GROUNDING AND BONDING COMPONENTS

A. General Requirements:
   1. Provide products listed, classified, and labeled as suitable for the purpose intended.
   2. Provide products listed and labeled as complying with UL 467 where applicable.

B. Conductors for Grounding and Bonding, in Addition to Requirements of Section 26 0526:
   1. Use insulated copper conductors unless otherwise indicated.
      a. Exceptions:
         1) Use bare copper conductors where installed underground in direct contact with earth.
         2) Use bare copper conductors where directly encased in concrete (not in raceway).
   2. Use exothermic welded connections for underground, concealed and other inaccessible connections.
   3. Use mechanical connectors, compression connectors, or exothermic welded connections for accessible connections.
      a. Exceptions:
         1) Use exothermic welded connections for connections to metal building frame.

4. Manufacturers - Mechanical and Compression Connectors:
   a. Advanced Lightning Technology (ALT); ______: www.altfab.com/#sle.
   b. Burndy LLC; ______: www.burndy.com/#sle.
   c. Harger Lightning & Grounding; ______: www.harger.com/#sle.
   d. Thomas & Betts Corporation; ______: www.tnb.com/#sle.
   e. Substitutions: See Section 01 6000 - Product Requirements.

5. Manufacturers - Exothermic Welded Connections:
   b. Cadweld, a brand of Erico International Corporation; ______: www.erico.com/#sle.
   c. thermOweld, subsidiary of Continental Industries; division of Burndy LLC; ______: www.thermoweld.com/#sle.
   d. Substitutions: See Section 01 6000 - Product Requirements.

D. Ground Bars:
   1. Description: Copper rectangular ground bars with mounting brackets and insulators.
   2. Size: As indicated.
   3. Holes for Connections: As indicated or as required for connections to be made.
   4. Manufacturers:
a. Advanced Lightning Technology (ALT); ______: www.altfab.com/#sle.
c. Harger Lightning & Grounding; __________: www.harger.com/#sle.
d. Substitutions: See Section 01 6000 - Product Requirements.

E. Ground Rod Electrodes:
   1. Comply with NEMA GR 1.
   3. Size: 3/4 inch (19 mm) diameter by 10 feet (3.0 m) length, unless otherwise indicated.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that work likely to damage grounding and bonding system components has been completed.
B. Verify that field measurements are as indicated.
C. Verify that conditions are satisfactory for installation prior to starting work.

3.02 INSTALLATION

A. Install products in accordance with manufacturer's instructions.
B. Perform work in accordance with NECA 1 (general workmanship).
C. Ground Rod Electrodes: Unless otherwise indicated, install ground rod electrodes vertically. Where encountered rock prohibits vertical installation, install at 45 degree angle or bury horizontally in trench at least 30 inches (750 mm) deep in accordance with NFPA 70 or provide ground plates.
   1. Outdoor Installations: Unless otherwise indicated, install with top of rod 6 inches (150 mm) below finished grade.
   2. Indoor Installations: Unless otherwise indicated, install with 4 inches (100 mm) of top of rod exposed.
D. Make grounding and bonding connections using specified connectors.
   1. Remove appropriate amount of conductor insulation for making connections without cutting, nicking or damaging conductors. Do not remove conductor strands to facilitate insertion into connector.
   2. Remove nonconductive paint, enamel, or similar coating at threads, contact points, and contact surfaces.
   3. Exothermic Welds: Make connections using molds and weld material suitable for the items to be connected in accordance with manufacturer's recommendations.
   4. Mechanical Connectors: Secure connections according to manufacturer's recommended torque settings.
   5. Compression Connectors: Secure connections using manufacturer's recommended tools and dies.
E. Identify grounding and bonding system components in accordance with Section 26 0553.

3.03 FIELD QUALITY CONTROL

A. See Section 01 4000 - Quality Requirements, for additional requirements.
B. Inspect and test in accordance with NETA ATS except Section 4.
C. Perform inspections and tests listed in NETA ATS, Section 7.13.
D. Perform ground electrode resistance tests under normally dry conditions. Precipitation within the previous 48 hours does not constitute normally dry conditions.
E. Investigate and correct deficiencies where measured ground resistances do not comply with specified requirements.

END OF SECTION
SECTION 26 0529
HANGERS AND SUPPORTS FOR ELECTRICAL SYSTEMS

PART 1 GENERAL

1.01 SECTION INCLUDES
A. Support and attachment components for equipment, conduit, cable, boxes, and other electrical work.

1.02 RELATED REQUIREMENTS
A. Section 03 3000 - Cast-in-Place Concrete: Concrete equipment pads.
B. Section 05 5000 - Metal Fabrications: Materials and requirements for fabricated metal supports.
C. Section 26 0533.13 - Conduit for Electrical Systems: Additional support and attachment requirements for conduits.
D. Section 26 0533.16 - Boxes for Electrical Systems: Additional support and attachment requirements for boxes.
E. Section 26 5100 - Interior Lighting: Additional support and attachment requirements for interior luminaires.
F. Section 26 5600 - Exterior Lighting: Additional support and attachment requirements for exterior luminaires.

1.03 REFERENCE STANDARDS
D. MFMA-4 - Metal Framing Standards Publication; 2004.
E. NECA 1 - Standard for Good Workmanship in Electrical Construction; 2015.
F. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

1.04 ADMINISTRATIVE REQUIREMENTS
A. Coordination:
   1. Coordinate sizes and arrangement of supports and bases with the actual equipment and components to be installed.
   2. Coordinate the work with other trades to provide additional framing and materials required for installation.
   3. Coordinate compatibility of support and attachment components with mounting surfaces at the installed locations.
   4. Coordinate the arrangement of supports with ductwork, piping, equipment and other potential conflicts installed under other sections or by others.
   5. Notify Architect of any conflicts with or deviations from the contract documents. Obtain direction before proceeding with work.
B. Sequencing:
   1. Do not install products on or provide attachment to concrete surfaces until concrete has fully cured in accordance with Section 03 3000.

1.05 SUBMITTALS
A. See Section 01 3000 - Administrative Requirements, for submittal procedures.
B. Product Data: Provide manufacturer's standard catalog pages and data sheets for metal channel (strut) framing systems, non-penetrating rooftop supports, and post-installed concrete and masonry anchors.

1.06 QUALITY ASSURANCE
A. Comply with NFPA 70.
B. Comply with applicable building code.
C. Installer Qualifications for Powder-Actuated Fasteners (when specified): Certified by fastener system manufacturer with current operator's license.
D. Installer Qualifications for Field-Welding: As specified in Section 05 5000.
E. Product Listing Organization Qualifications: An organization recognized by OSHA as a Nationally Recognized Testing Laboratory (NRTL) and acceptable to authorities having jurisdiction.

1.07 DELIVERY, STORAGE, AND HANDLING
A. Receive, inspect, handle, and store products in accordance with manufacturer's instructions.

PART 2 PRODUCTS

2.01 SUPPORT AND ATTACHMENT COMPONENTS
A. General Requirements:
   1. Provide all required hangers, supports, anchors, fasteners, fittings, accessories, and hardware as necessary for the complete installation of electrical work.
   2. Provide products listed, classified, and labeled as suitable for the purpose intended, where applicable.
   3. Where support and attachment component types and sizes are not indicated, select in accordance with manufacturer's application criteria as required for the load to be supported with a minimum safety factor of ______. Include consideration for vibration, equipment operation, and shock loads where applicable.
   4. Do not use products for applications other than as permitted by NFPA 70 and product listing.
   5. Steel Components: Use corrosion resistant materials suitable for the environment where installed.
      a. Indoor Dry Locations: Use zinc-plated steel or approved equivalent unless otherwise indicated.
      b. Outdoor and Damp or Wet Indoor Locations: Use galvanized steel, stainless steel, or approved equivalent unless otherwise indicated.
      c. Zinc-Plated Steel: Electroplated in accordance with ASTM B633.
      d. Galvanized Steel: Hot-dip galvanized after fabrication in accordance with ASTM A123/A123M or ASTM A153/A153M.
B. Materials for Metal Fabricated Supports: Comply with Section 05 5000.
C. Conduit and Cable Supports: Straps, clamps, etc. suitable for the conduit or cable to be supported.
   1. Conduit Straps: One-hole or two-hole type; steel or malleable iron.
   2. Conduit Clamps: Bolted type unless otherwise indicated.
   3. Manufacturers:
      d. Thomas & Betts Corporation; __________: www.tnb.com/#sle.
      e. Substitutions: See Section 01 6000 - Product Requirements.
D. Outlet Box Supports: Hangers, brackets, etc. suitable for the boxes to be supported.
   1. Manufacturers:
a. Cooper Crouse-Hinds, a division of Eaton Corporation; _________:  
www.cooperindustries.com/#sle.
d. Thomas & Betts Corporation; _________: www.tnb.com/#sle.
e. Substitutions: See Section 01 6000 - Product Requirements.

E. Metal Channel (Strut) Framing Systems: Factory-fabricated continuous-slot metal channel (strut) and associated fittings, accessories, and hardware required for field-assembly of supports.

F. Hanger Rods: Threaded zinc-plated steel unless otherwise indicated.
   1. Minimum Size, Unless Otherwise Indicated or Required:
      a. Equipment Supports: 1/2 inch (13 mm) diameter.
      b. Single Conduit up to 1 inch (27 mm) trade size: 1/4 inch (6 mm) diameter.
      c. Single Conduit larger than 1 inch (27 mm) trade size: 3/8 inch (10 mm) diameter.
      d. Trapeze Support for Multiple Conduits: 3/8 inch (10 mm) diameter.
      e. Outlet Boxes: 1/4 inch (6 mm) diameter.
      f. Luminaires: 1/4 inch (6 mm) diameter.

G. Anchors and Fasteners:
   1. Unless otherwise indicated and where not otherwise restricted, use the anchor and fastener types indicated for the specified applications.
   2. Concrete: Use preset concrete inserts, expansion anchors, or screw anchors.
   3. Steel: Use beam clamps, machine bolts, or welded threaded studs.
   4. Preset Concrete Inserts: Continuous metal channel (strut) and spot inserts specifically designed to be cast in concrete ceilings, walls, and floors.
      b. Channel Material: Use galvanized steel.
      c. Manufacturer: Same as manufacturer of metal channel (strut) framing system.

PART 3 EXECUTION

3.01 EXAMINATION
   A. Verify that field measurements are as indicated.
   B. Verify that mounting surfaces are ready to receive support and attachment components.
   C. Verify that conditions are satisfactory for installation prior to starting work.

3.02 INSTALLATION
   A. Install products in accordance with manufacturer's instructions.
   B. Perform work in accordance with NECA 1 (general workmanship).
   C. Provide independent support from building structure. Do not provide support from piping, ductwork, or other systems.
   D. Unless specifically indicated or approved by Architect, do not provide support from suspended ceiling support system or ceiling grid.
   E. Unless specifically indicated or approved by Architect, do not provide support from roof deck.
   F. Do not penetrate or otherwise notch or cut structural members without approval of Structural Engineer.
   G. Equipment Support and Attachment:
      1. Use metal fabricated supports or supports assembled from metal channel (strut) to support equipment as required.
      2. Use metal channel (strut) secured to studs to support equipment surface-mounted on hollow stud walls when wall strength is not sufficient to resist pull-out.
      3. Use metal channel (strut) to support surface-mounted equipment in wet or damp locations to provide space between equipment and mounting surface.
4. Unless otherwise indicated, mount floor-mounted equipment on properly sized 3 inch (80 mm) high concrete pad constructed in accordance with Section 03 3000.
5. Securely fasten floor-mounted equipment. Do not install equipment such that it relies on its own weight for support.

H. Conduit Support and Attachment: Also comply with Section 26 0533.13.
I. Box Support and Attachment: Also comply with Section 26 0533.16.
J. Interior Luminaire Support and Attachment: Also comply with Section 26 5100.
K. Exterior Luminaire Support and Attachment: Also comply with Section 26 5600.
L. Preset Concrete Inserts: Use manufacturer provided closure strips to inhibit concrete seepage during concrete pour.
M. Secure fasteners according to manufacturer's recommended torque settings.
N. Remove temporary supports.

3.03 FIELD QUALITY CONTROL

A. See Section 01 4000 - Quality Requirements, for additional requirements.
B. Inspect support and attachment components for damage and defects.
C. Repair cuts and abrasions in galvanized finishes using zinc-rich paint recommended by manufacturer. Replace components that exhibit signs of corrosion.
D. Correct deficiencies and replace damaged or defective support and attachment components.

END OF SECTION
SECTION 26 0533.13
CONDUIT FOR ELECTRICAL SYSTEMS

PART 1 GENERAL

1.01 SECTION INCLUDES
A. Galvanized steel rigid metal conduit (RMC).
B. Aluminum rigid metal conduit (RMC).
C. Intermediate metal conduit (IMC).
D. PVC-coated galvanized steel rigid metal conduit (RMC).
E. Flexible metal conduit (FMC).
F. Liquidtight flexible metal conduit (LFMC).
G. Electrical metallic tubing (EMT).
H. Rigid polyvinyl chloride (PVC) conduit.
I. Electrical nonmetallic tubing (ENT).
J. Conduit fittings.
K. Accessories.

1.02 RELATED REQUIREMENTS
A. Section 03 3000 - Cast-in-Place Concrete: Concrete encasement of conduits.
B. Section 07 8400 - Firestopping.
C. Section 26 0526 - Grounding and Bonding for Electrical Systems.
   1. Includes additional requirements for fittings for grounding and bonding.
D. Section 26 0529 - Hangers and Supports for Electrical Systems.
E. Section 26 0533.16 - Boxes for Electrical Systems.
F. Section 26 0533.23 - Surface Raceways for Electrical Systems.
G. Section 26 0539 - Underfloor Raceways for Electrical Systems.
H. Section 26 0553 - Identification for Electrical Systems: Identification products and requirements.
I. Section 26 2100 - Low-Voltage Electrical Service Entrance: Additional requirements for electrical service conduits.
J. Section 27 1005 - Structured Cabling for Voice and Data - Inside-Plant: Additional requirements for communications systems conduits.
K. Section 31 2316.13 - Trenching: Excavating, bedding, and backfilling.
L. Section 33 7119 - Electrical Underground Ducts, Ductbanks, and Manholes.

1.03 REFERENCE STANDARDS
A. ANSI C80.1 - American National Standard for Electrical Rigid Steel Conduit (ERSC); 2015.
B. ANSI C80.3 - American National Standard for Electrical Metallic Tubing -- Steel (EMT-S); 2015.
C. ANSI C80.5 - American National Standard for Electrical Rigid Metal Conduit -- Aluminum (ERMC-A); 2015.
D. ANSI C80.6 - American National Standard for Electrical Intermediate Metal Conduit (EIMC); 2005.
E. NECA 1 - Standard for Good Workmanship in Electrical Construction; 2015.
F. NECA 101 - Standard for Installing Steel Conduits (Rigid, IMC, EMT); 2013.
H. NECA 111 - Standard for Installing Nonmetallic Raceways (RNC, ENT, LFNC); 2003.
I. NEMA FB 1 - Fittings, Cast Metal Boxes, and Conduit Bodies for Conduit, Electrical Metallic Tubing, and Cable; 2014.

J. NEMA RN 1 - Polyvinyl-Chloride (PVC) Externally Coated Galvanized Rigid Steel Conduit and Intermediate Metal Conduit; 2005 (Reaffirmed 2013).


L. NEMA TC 3 - Polyvinyl Chloride (PVC) Fittings for Use with Rigid PVC Conduit and Tubing; 2016.

M. NEMA TC 13 - Electrical Nonmetallic Tubing (ENT); 2014.

N. NEMA TC 14 (SERIES) - Reinforced Thermosetting Resin Conduit and Fittings Series; 2015.

O. NEMA TC 14.AG - Aboveground Reinforced Thermosetting Resin Conduit (RTRC) and Fittings; 2015.

P. NEMA TC 14.BG - Belowground Reinforced Thermosetting Resin Conduit (RTRC) and Fittings; 2015.

Q. NEMA TC 14.XW - Extra Heavy Wall Aboveground Reinforced Thermosetting Resin Conduit (RTRC) and Fittings; 2015.

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

S. UL 1 - Flexible Metal Conduit; Current Edition, Including All Revisions.

T. UL 6 - Electrical Rigid Metal Conduit-Steel; Current Edition, Including All Revisions.


V. UL 360 - Liquid-Tight Flexible Steel Conduit; Current Edition, Including All Revisions.

W. UL 514B - Conduit, Tubing, and Cable Fittings; Current Edition, Including All Revisions.

X. UL 651 - Schedule 40, 80, Type EB and A Rigid PVC Conduit and Fittings; Current Edition, Including All Revisions.

Y. UL 797 - Electrical Metallic Tubing-Steel; Current Edition, Including All Revisions.

Z. UL 1242 - Electrical Intermediate Metal Conduit-Steel; Current Edition, Including All Revisions.

AA. UL 1653 - Electrical Nonmetallic Tubing; Current Edition, Including All Revisions.


AC. UL 2420 - Belowground Reinforced Thermosetting Resin Conduit (RTRC) and Fittings; Current Edition, Including All Revisions.

AD. UL 2515 - Aboveground Reinforced Thermosetting Resin Conduit (RTRC) and Fittings; Current Edition, Including All Revisions.

AE. UL 2515A - Standard for Supplemental Requirements for Extra Heavy Wall Reinforced Thermosetting Resin Conduit (RTRC) and Fittings; Current Edition, Including All Revisions.

1.04 ADMINISTRATIVE REQUIREMENTS

A. Coordination:

1. Coordinate minimum sizes of conduits with the actual conductors to be installed, including adjustments for conductor sizes increased for voltage drop.

2. Coordinate the arrangement of conduits with structural members, ductwork, piping, equipment and other potential conflicts installed under other sections or by others.

3. Verify exact conduit termination locations required for boxes, enclosures, and equipment installed under other sections or by others.

4. Coordinate the work with other trades to provide roof penetrations that preserve the integrity of the roofing system and do not void the roof warranty.

5. Notify Architect of any conflicts with or deviations from the contract documents. Obtain direction before proceeding with work.
B. Sequencing:
   1. Do not begin installation of conductors and cables until installation of conduit is complete between outlet, junction and splicing points.

1.05 SUBMITTALS
A. See Section 01 3000 - Administrative Requirements for submittals procedures.

1.06 QUALITY ASSURANCE
A. Conform to requirements of NFPA 70.
B. Maintain at the project site a copy of each referenced document that prescribes execution requirements.
C. Product Listing Organization Qualifications: An organization recognized by OSHA as a Nationally Recognized Testing Laboratory (NRTL) and acceptable to authorities having jurisdiction.

1.07 DELIVERY, STORAGE, AND HANDLING
A. Receive, inspect, handle, and store conduit and fittings in accordance with manufacturer's instructions.

PART 2 PRODUCTS
2.01 CONDUIT APPLICATIONS
A. Do not use conduit and associated fittings for applications other than as permitted by NFPA 70 and product listing.
B. Unless otherwise indicated and where not otherwise restricted, use the conduit types indicated for the specified applications. Where more than one listed application applies, comply with the most restrictive requirements. Where conduit type for a particular application is not specified, use galvanized steel rigid metal conduit.
C. Underground:
   1. Under Slab on Grade: Use galvanized steel rigid metal conduit, intermediate metal conduit (IMC), PVC-coated galvanized steel rigid metal conduit, rigid PVC conduit, or reinforced thermosetting resin conduit (RTRC).
   2. Exterior, Direct-Buried: Use galvanized steel rigid metal conduit, intermediate metallic conduit (IMC), PVC-coated galvanized steel rigid metal conduit, rigid PVC conduit, or reinforced thermosetting resin conduit (RTRC).
   3. Exterior, Embedded Within Concrete: Use galvanized steel rigid metal conduit, intermediate metallic conduit (IMC), PVC-coated galvanized steel rigid metal conduit, rigid PVC conduit, or reinforced thermosetting resin conduit (RTRC).
   4. Where rigid polyvinyl (PVC) conduit is provided, transition to galvanized steel rigid metal conduit where emerging from underground.
   5. Where rigid polyvinyl (PVC) conduit larger than 2 inch (53 mm) trade size is provided, use galvanized steel rigid metal conduit elbows for bends.
   6. Where steel conduit is installed in direct contact with earth where soil has a resistivity of less than 2000 ohm-centimeters or is characterized as severely corrosive based on soils report or local experience, use corrosion protection tape to provide supplementary corrosion protection or use PVC-coated galvanized steel rigid metal conduit.
   7. Where steel conduit emerges from concrete into soil, use corrosion protection tape to provide supplementary corrosion protection for a minimum of 4 inches (100 mm) on either side of where conduit emerges or use PVC-coated galvanized steel rigid metal conduit.
D. Embedded Within Concrete:
   1. Within Slab on Grade (within structural slabs only where approved by Structural Engineer): Use galvanized steel rigid metal conduit, intermediate metal conduit (IMC), PVC-coated galvanized steel rigid metal conduit, rigid PVC conduit, or reinforced thermosetting resin conduit (RTRC).
2. Within Slab Above Ground (within structural slabs only where approved by Structural Engineer): Use galvanized steel rigid metal conduit, intermediate metal conduit (IMC), PVC-coated galvanized steel rigid metal conduit, rigid PVC conduit, or reinforced thermosetting resin conduit (RTRC).

3. Within Concrete Walls Above Ground: Use galvanized steel rigid metal conduit, intermediate metal conduit (IMC), PVC-coated galvanized steel rigid metal conduit, rigid PVC conduit, or reinforced thermosetting resin conduit (RTRC).

4. Where rigid polyvinyl (PVC) conduit is provided, transition to galvanized steel rigid metal conduit where emerging from concrete.

5. Where electrical metallic tubing (EMT) emerges from concrete into salt air, use corrosion protection tape to provide supplementary corrosion protection for a minimum of 4 inches (100 mm) on either side of where conduit emerges or use PVC-coated galvanized steel rigid metal conduit.

E. Concealed Within Masonry Walls: Use galvanized steel rigid metal conduit, intermediate metal conduit (IMC), or electrical metallic tubing (EMT).

F. Concealed Within Hollow Stud Walls: Use galvanized steel rigid metal conduit, intermediate metal conduit (IMC), or electrical metallic tubing (EMT).

G. Concealed Above Accessible Ceilings: Use galvanized steel rigid metal conduit, intermediate metal conduit (IMC), or electrical metallic tubing (EMT).

H. Interior, Damp or Wet Locations: Use galvanized steel rigid metal conduit.

I. Exposed, Interior, Not Subject to Physical Damage: Use galvanized steel rigid metal conduit, intermediate metal conduit (IMC), or electrical metallic tubing (EMT).

J. Exposed, Interior, Subject to Physical Damage: Use galvanized steel rigid metal conduit or intermediate metal conduit (IMC).

1. Locations subject to physical damage include, but are not limited to:
   a. Where exposed below 8 feet (2.4 m), except within electrical and communication rooms or closets.
   b. Where exposed below 20 feet (6.1 m) in warehouse areas.

K. Exposed, Exterior: Use galvanized steel rigid metal conduit, intermediate metal conduit (IMC), or PVC-coated galvanized steel rigid metal conduit.

L. Concealed, Exterior, Not Embedded in Concrete or in Contact With Earth: Use galvanized steel rigid metal conduit or intermediate metal conduit (IMC).

M. Corrosive Locations Above Ground: Use PVC-coated galvanized steel rigid metal conduit, aluminum rigid metal conduit, or reinforced thermosetting resin conduit (RTRC).

1. Corrosive locations include, but are not limited to:

N. Hazardous (Classified) Locations: Use galvanized steel rigid metal conduit, intermediate metal conduit (IMC), aluminum rigid metal conduit, or PVC-coated galvanized steel rigid metal conduit.

O. Connections to Luminaires Above Accessible Ceilings: Use flexible metal conduit.

1. Maximum Length: 6 feet (1.8 m).

P. Connections to Vibrating Equipment:

1. Dry Locations: Use flexible metal conduit.

2. Damp, Wet, or Corrosive Locations: Use liquidtight flexible metal conduit.

3. Maximum Length: 6 feet (1.8 m) unless otherwise indicated.

4. Vibrating equipment includes, but is not limited to:
   a. Transformers.
   b. Motors.

Q. Fished in Existing Walls, Where Necessary: Use flexible metal conduit.
2.02 CONDUIT REQUIREMENTS

A. Existing Work: Where existing conduits are indicated to be reused, they may be reused only where they comply with specified requirements, are free from corrosion, and integrity is verified by pulling a mandrel through them.

B. Electrical Service Conduits: Also comply with Section 26 2100.

C. Communications Systems Conduits: Also comply with Section 27 1005.

D. Fittings for Grounding and Bonding: Also comply with Section 26 0526.

E. Provide all conduit, fittings, supports, and accessories required for a complete raceway system.

F. Provide products listed, classified, and labeled as suitable for the purpose intended.

G. Minimum Conduit Size, Unless Otherwise Indicated:
   1. Branch Circuits: 1/2 inch (16 mm) trade size.

H. Where conduit size is not indicated, size to comply with NFPA 70 but not less than applicable minimum size requirements specified.

2.03 GALVANIZED STEEL RIGID METAL CONDUIT (RMC)

A. Manufacturers:
   4. Substitutions: See Section 01 6000 - Product Requirements.

B. Description: NFPA 70, Type RMC galvanized steel rigid metal conduit complying with ANSI C80.1 and listed and labeled as complying with UL 6.

C. Fittings:
   1. Manufacturers:
      d. ________
      e. Substitutions: See Section 01 6000 - Product Requirements.
   2. Non-Hazardous Locations: Use fittings complying with NEMA FB 1 and listed and labeled as complying with UL 514B.
   3. Hazardous (Classified) Locations: Use fittings listed and labeled as complying with UL 1203 for the classification of the installed location.
   4. Material: Use steel or malleable iron.
      a. Do not use die cast zinc fittings.
   5. Connectors and Couplings: Use threaded type fittings only. Threadless set screw and compression (gland) type fittings are not permitted.

2.04 ALUMINUM RIGID METAL CONDUIT (RMC)

A. Manufacturers:
   4. ________
   5. Substitutions: See Section 01 6000 - Product Requirements.

B. Description: NFPA 70, Type RMC aluminum rigid metal conduit complying with ANSI C80.5 and listed and labeled as complying with UL 6A.

C. Fittings:
   1. Manufacturers:
2. _______.
3. Substitutions: See Section 01 6000 - Product Requirements.

2. Non-Hazardous Locations: Use fittings complying with NEMA FB 1 and listed and labeled as complying with UL 514B.

3. Hazardous (Classified) Locations: Use fittings listed and labeled as complying with UL 1203 for the classification of the installed location.


5. Connectors and Couplings: Use threaded type fittings only. Threadless set screw and compression (gland) type fittings are not permitted.

2.05 INTERMEDIATE METAL CONDUIT (IMC)

A. Manufacturers:
4. Substitutions: See Section 01 6000 - Product Requirements.

B. Description: NFPA 70, Type IMC galvanized steel intermediate metal conduit complying with ANSI C80.6 and listed and labeled as complying with UL 1242.

C. Fittings:
1. Manufacturers:
   d. Substitutions: See Section 01 6000 - Product Requirements.

2. Non-Hazardous Locations: Use fittings complying with NEMA FB 1 and listed and labeled as complying with UL 514B.

3. Hazardous (Classified) Locations: Use fittings listed and labeled as complying with UL 1203 for the classification of the installed location.

4. Material: Use steel or malleable iron.

5. Connectors and Couplings: Use threaded type fittings only. Threadless set screw and compression (gland) type fittings are not permitted.

2.06 PVC-COATED GALVANIZED STEEL RIGID METAL CONDUIT (RMC)

A. Manufacturers:
3. Substitutions: See Section 01 6000 - Product Requirements.

B. Description: NFPA 70, Type RMC galvanized steel rigid metal conduit with external polyvinyl chloride (PVC) coating complying with NEMA RN 1 and listed and labeled as complying with UL 6.

C. Exterior Coating: Polyvinyl chloride (PVC), nominal thickness of 40 mil (1.02 mm).

D. Interior Coating: Urethane, minimum thickness of 2 mil (0.05 mm).

E. PVC-Coated Fittings:
1. Manufacturer: Same as manufacturer of PVC-coated conduit to be installed.
2. Non-Hazardous Locations: Use fittings listed and labeled as complying with UL 514B.
3. Hazardous (Classified) Locations: Use fittings listed and labeled as complying with UL 1203 for the classification of the installed location.
4. Material: Use steel or malleable iron.
5. Exterior Coating: Polyvinyl chloride (PVC), minimum thickness of 40 mil (1.02 mm).
6. Interior Coating: Urethane, minimum thickness of 2 mil (0.05 mm).

F. PVC-Coated Supports: Furnish with exterior coating of polyvinyl chloride (PVC), minimum thickness of 15 mil (0.38 mm).
2.07 FLEXIBLE METAL CONDUIT (FMC)
A. Manufacturers:
   1. Substitutions: See Section 01 6000 - Product Requirements.
B. Description: NFPA 70, Type FMC standard wall steel flexible metal conduit listed and labeled as complying with UL 1, and listed for use in classified firestop systems to be used.
C. Fittings:
   1. Manufacturers:
      d. Substitutions: See Section 01 6000 - Product Requirements.
   2. Description: Fittings complying with NEMA FB 1 and listed and labeled as complying with UL 514B.
   3. Material: Use steel or malleable iron.

2.08 LIQUIDTIGHT FLEXIBLE METAL CONDUIT (LFMC)
A. Manufacturers:
   1. AFC Cable Systems, Inc; ______: www.afcweb.com/#sle.
   2. Electri-Flex Company; ______: www.electriflex.com/#sle.
   3. International Metal Hose; ______: www.metalhose.com/#sle.
   4. Substitutions: See Section 01 6000 - Product Requirements.
B. Description: NFPA 70, Type LFMC polyvinyl chloride (PVC) jacketed steel flexible metal conduit listed and labeled as complying with UL 360.
C. Fittings:
   1. Manufacturers:
      d. Substitutions: See Section 01 6000 - Product Requirements.
   2. Description: Fittings complying with NEMA FB 1 and listed and labeled as complying with UL 514B.
   3. Material: Use steel or malleable iron.

2.09 ELECTRICAL METALLIC TUBING (EMT)
A. Manufacturers:
   4. Substitutions: See Section 01 6000 - Product Requirements.
B. Description: NFPA 70, Type EMT steel electrical metallic tubing complying with ANSI C80.3 and listed and labeled as complying with UL 797.
C. Fittings:
   1. Manufacturers:
      d. Substitutions: See Section 01 6000 - Product Requirements.
   2. Description: Fittings complying with NEMA FB 1 and listed and labeled as complying with UL 514B.
   3. Material: Use steel or malleable iron.
      a. Do not use die cast zinc fittings.
   4. Connectors and Couplings: Use compression (gland) or set-screw type.
      a. Do not use indenter type connectors and couplings.
5. Damp or Wet Locations (where permitted): Use fittings listed for use in wet locations.
6. Embedded Within Concrete (where permitted): Use fittings listed as concrete-tight. Fittings that require taping to be concrete-tight are acceptable.

2.10 RIGID POLYVINYL CHLORIDE (PVC) CONDUIT

A. Manufacturers:
   4. Substitutions: See Section 01 6000 - Product Requirements.

B. Description: NFPA 70, Type PVC rigid polyvinyl chloride conduit complying with NEMA TC 2 and listed and labeled as complying with UL 651; Schedule 40 unless otherwise indicated, Schedule 80 where subject to physical damage; rated for use with conductors rated 90 degrees C.

C. Fittings:
   1. Manufacturer: Same as manufacturer of conduit to be connected.
   2. Description: Fittings complying with NEMA TC 3 and listed and labeled as complying with UL 651; material to match conduit.

2.11 ELECTRICAL NONMETALLIC TUBING (ENT)

A. Manufacturers:
   2. Carlon, a brand of Thomas & Betts Corporation; ______: www.carlon.com/#sle.
   3. ______.

B. Description: NFPA 70, Type ENT electrical nonmetallic tubing complying with NEMA TC 13 and listed and labeled as complying with UL 1653.

C. Fittings:
   1. Manufacturer: Same as manufacturer of ENT to be connected.
   2. Use solvent-welded type fittings.
   3. Solvent-Welded Fittings: Rigid PVC fittings complying with NEMA TC 3 and listed and labeled as complying with UL 651; suitable for use with ENT.
   4. Snap-on Fittings: Listed and labeled as complying with UL 651.

2.12 LIQUIDTIGHT FLEXIBLE NONMETALLIC CONDUIT (LFNC)

A. Manufacturers:
   1. AFC Cable Systems, Inc: www.afcweb.com/#sle.
   4. Substitutions: See Section 01 6000 - Product Requirements.

B. Description: NFPA 70, Type LFNC liquidtight flexible nonmetallic conduit listed and labeled as complying with UL 1660.

C. Fittings:
   1. Manufacturer: Same as manufacturer of conduit to be connected.
   2. Description: Fittings complying with NEMA FB 1 and listed and labeled as complying with UL 514B; suitable for the type of conduit to be connected.

2.13 REINFORCED THERMOSETTING RESIN CONDUIT (RTRC)

A. Applications:
   1. Above Ground, Not Subject to Physical Damage: Use aboveground (AG), SW (Standard Wall), HW (Heavy Wall), or XW (Extra Heavy Wall) RTRC.
   2. Above Ground, Subject to Physical Damage: Use aboveground (AG), XW (Extra Heavy Wall) RTRC.
   3. Underground, Direct-Buried: Use belowground (BG), DB (direct burial) RTRC or aboveground (AG) RTRC.
4. Underground, Embedded in Concrete: Use belowground (BG), EB (encased burial) RTRC, belowground (BG), DB (direct burial) RTRC, or aboveground (AG) RTRC.
5. Do not use RTRC in hazardous (classified) locations.

B. Description: NFPA 70, Type RTRC reinforced thermosetting resin conduit complying with NEMA TC 14 (SERIES).
   1. Aboveground (AG) RTRC: Comply with NEMA TC 14.AG and list and label as complying with UL 2515.
   2. Aboveground (AG), XW (Extra Heavy Wall) RTRC: Comply with NEMA TC 14.XW and list and label as complying with UL 2515A.
   3. Belowground (BG) RTRC: Comply with NEMA TC 14.BG and list and label as complying with UL 2420.

C. Supports: Per manufacturer's recommendations.

D. Fittings: Same type and manufacturer as conduit to be connected.
   1. Cement-Tight Joints: Use bonded coupling or bell and spigot.

2.14 ACCESSORIES
A. Corrosion Protection Tape: PVC-based, minimum thickness of 20 mil (0.51 mm).
B. Conduit Joint Compound: Corrosion-resistant, electrically conductive; suitable for use with the conduit to be installed.
C. Solvent Cement for PVC Conduit and Fittings: As recommended by manufacturer of conduit and fittings to be installed.
D. Epoxy Adhesive for RTRC Conduit and Fittings: As recommended by manufacturer of conduit and fittings to be installed.
E. Pull Strings: Use nylon cord with average breaking strength of not less than 200 pound-force (890 N).
F. Sealing Compound for Sealing Fittings: Listed for use with the particular fittings to be installed.
G. Modular Seals for Conduit Penetrations: Rated for minimum of 40 psig; Suitable for the conduits to be installed.
   1. Product: __________.
   2. Substitutions: See Section 01 6000 - Product Requirements.

PART 3 EXECUTION
3.01 EXAMINATION
A. Verify that field measurements are as indicated.
B. Verify that mounting surfaces are ready to receive conduits.
C. Verify that conditions are satisfactory for installation prior to starting work.

3.02 INSTALLATION
A. Install products in accordance with manufacturer's instructions.
B. Perform work in accordance with NECA 1 (general workmanship).
C. Install galvanized steel rigid metal conduit (RMC) in accordance with NECA 101.
D. Install aluminum rigid metal conduit (RMC) in accordance with NECA 102.
E. Install intermediate metal conduit (IMC) in accordance with NECA 101.
F. Install PVC-coated galvanized steel rigid metal conduit (RMC) using only tools approved by the manufacturer.
G. Install rigid polyvinyl chloride (PVC) conduit in accordance with NECA 111.
H. Install electrical nonmetallic tubing (ENT) in accordance with NECA 111.
I. Install liquidtight flexible nonmetallic conduit (LFNC) in accordance with NECA 111.
J. Conduit Routing:
1. Unless dimensioned, conduit routing indicated is diagrammatic.
2. When conduit destination is indicated without specific routing, determine exact routing required.
3. Conceal all conduits unless specifically indicated to be exposed.
4. Conduits in the following areas may be exposed, unless otherwise indicated:
   a. Electrical rooms.
   b. Mechanical equipment rooms.
   c. Within joists in areas with no ceiling.
5. Unless otherwise approved, do not route conduits exposed:
   a. Across floors.
   b. Across roofs.
   c. Across top of parapet walls.
   d. Across building exterior surfaces.
   e. __________.
6. Conduits installed underground or embedded in concrete may be routed in the shortest possible manner unless otherwise indicated. Route all other conduits parallel or perpendicular to building structure and surfaces, following surface contours where practical.
7. Arrange conduit to maintain adequate headroom, clearances, and access.
8. Arrange conduit to provide no more than the equivalent of four 90 degree bends between pull points.
9. Arrange conduit to provide no more than 150 feet (46 m) between pull points.
10. Route conduits above water and drain piping where possible.
11. Arrange conduit to prevent moisture traps. Provide drain fittings at low points and at sealing fittings where moisture may collect.
12. Maintain minimum clearance of 6 inches (150 mm) between conduits and piping for other systems.
13. Maintain minimum clearance of 12 inches (300 mm) between conduits and hot surfaces. This includes, but is not limited to:
   a. Heaters.
   b. Hot water piping.
   c. Flues.
14. Group parallel conduits in the same area together on a common rack.

K. Conduit Support:
1. Secure and support conduits in accordance with NFPA 70 and Section 26 0529 using suitable supports and methods approved by the authority having jurisdiction.
2. Provide independent support from building structure. Do not provide support from piping, ductwork, or other systems.
3. Installation Above Suspended Ceilings: Do not provide support from ceiling support system. Do not provide support from ceiling grid or allow conduits to lay on ceiling tiles.
4. Use conduit strap to support single surface-mounted conduit.
   a. Use clamp back spacer with conduit strap for damp and wet locations to provide space between conduit and mounting surface.
5. Use metal channel (strut) with accessory conduit clamps to support multiple parallel surface-mounted conduits.
6. Use conduit clamp to support single conduit from beam clamp or threaded rod.
7. Use trapeze hangers assembled from threaded rods and metal channel (strut) with accessory conduit clamps to support multiple parallel suspended conduits.
8. Use non-penetrating rooftop supports to support conduits routed across rooftops (only where approved).
9. Use of spring steel conduit clips for support of conduits is not permitted.
10. Use of wire for support of conduits is not permitted.
   a. For securing conduits to studs in hollow stud walls.
b. For suspending conduits supported by spring steel conduit clips (only where specifically indicated or permitted).

11. Where conduit support intervals specified in NFPA 70 and NECA standards differ, comply with the most stringent requirements.

L. Connections and Terminations:
1. Use approved zinc-rich paint or conduit joint compound on field-cut threads of galvanized steel conduits prior to making connections.
2. Where two threaded conduits must be joined and neither can be rotated, use three-piece couplings or split couplings. Do not use running threads.
3. Use suitable adapters where required to transition from one type of conduit to another.
4. Provide drip loops for liquidtight flexible conduit connections to prevent drainage of liquid into connectors.
5. Terminate threaded conduits in boxes and enclosures using threaded hubs or double lock nuts for dry locations and raintight hubs for wet locations.
6. Where spare conduits stub up through concrete floors and are not terminated in a box or enclosure, provide threaded couplings equipped with threaded plugs set flush with finished floor.
7. Provide insulating bushings or insulated throats at all conduit terminations to protect conductors.
8. Secure joints and connections to provide maximum mechanical strength and electrical continuity.

M. Penetrations:
1. Do not penetrate or otherwise notch or cut structural members, including footings and grade beams, without approval of Structural Engineer.
2. Make penetrations perpendicular to surfaces unless otherwise indicated.
3. Provide sleeves for penetrations as indicated or as required to facilitate installation. Set sleeves flush with exposed surfaces unless otherwise indicated or required.
4. Conceal bends for conduit risers emerging above ground.
5. Seal interior of conduits entering the building from underground at first accessible point to prevent entry of moisture and gases.
6. Provide suitable modular seal where conduits penetrate exterior wall below grade.
7. Where conduits penetrate waterproof membrane, seal as required to maintain integrity of membrane.
8. Make penetrations for roof-mounted equipment within associated equipment openings and curbs where possible to minimize roofing system penetrations. Where penetrations are necessary, seal as indicated or as required to preserve integrity of roofing system and maintain roof warranty. Include proposed locations of penetrations and methods for sealing with submittals.
9. Provide metal escutcheon plates for conduit penetrations exposed to public view.
10. Install firestopping to preserve fire resistance rating of partitions and other elements, using materials and methods specified in Section 07 8400.

N. Underground Installation:
1. Provide trenching and backfilling in accordance with Section 31 2316.13.
2. Minimum Cover, Unless Otherwise Indicated or Required:
   b. Under Slab on Grade: 12 inches (300 mm) to bottom of slab.
3. Provide underground warning tape in accordance with Section 26 0553 along entire conduit length for service entrance where not concrete-encased.

O. Embedment Within Structural Concrete Slabs (only where approved by Structural Engineer):
1. Include proposed conduit arrangement with submittals.
2. Maximum Conduit Size: 1 inch (27 mm) unless otherwise approved.
3. Install conduits within middle one third of slab thickness.
4. Secure conduits to prevent floating or movement during pouring of concrete.
P. Concrete Encasement: Where conduits not otherwise embedded within concrete are indicated to be concrete-encased, provide concrete in accordance with Section 03 3000 with minimum concrete cover of 3 inches (76 mm) on all sides unless otherwise indicated.

Q. Hazardous (Classified) Locations: Where conduits cross boundaries of hazardous (classified) locations, provide sealing fittings located as indicated or in accordance with NFPA 70.

R. Conduit Movement Provisions: Where conduits are subject to movement, provide expansion and expansion/deflection fittings to prevent damage to enclosed conductors or connected equipment. This includes, but is not limited to:
   1. Where conduits cross structural joints intended for expansion, contraction, or deflection.
   2. Where calculated in accordance with NFPA 70 for rigid polyvinyl chloride (PVC) conduit installed above ground to compensate for thermal expansion and contraction.
   3. Where calculated in accordance with NFPA 70 for reinforced thermosetting resin conduit (RTRC) conduit installed above ground to compensate for thermal expansion and contraction.
   4. Where conduits are subject to earth movement by settlement or frost.

S. Condensation Prevention: Where conduits cross barriers between areas of potential substantial temperature differential, provide sealing fitting or approved sealing compound at an accessible point near the penetration to prevent condensation. This includes, but is not limited to:
   1. Where conduits pass from outdoors into conditioned interior spaces.
   2. Where conduits pass from unconditioned interior spaces into conditioned interior spaces.

T. Provide pull string in all empty conduits and in conduits where conductors and cables are to be installed by others. Leave minimum slack of 12 inches (300 mm) at each end.

U. Provide grounding and bonding in accordance with Section 26 0526.

V. Identify conduits in accordance with Section 26 0553.

3.03 FIELD QUALITY CONTROL
   A. See Section 01 4000 - Quality Requirements, for additional requirements.
   B. Repair cuts and abrasions in galvanized finishes using zinc-rich paint recommended by manufacturer. Replace components that exhibit signs of corrosion.
   C. Where coating of PVC-coated galvanized steel rigid metal conduit (RMC) contains cuts or abrasions, repair in accordance with manufacturer’s instructions.
   D. Correct deficiencies and replace damaged or defective conduits.

3.04 CLEANING
   A. Clean interior of conduits to remove moisture and foreign matter.

3.05 PROTECTION
   A. Immediately after installation of conduit, use suitable manufactured plugs to provide protection from entry of moisture and foreign material and do not remove until ready for installation of conductors.

END OF SECTION
SECTION 26 0533.16
BOXES FOR ELECTRICAL SYSTEMS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Outlet and device boxes up to 100 cubic inches (1,650 cu cm), including those used as junction and pull boxes.
B. Cabinets and enclosures, including junction and pull boxes larger than 100 cubic inches (1,650 cu cm).
C. Boxes and enclosures for integrated power, data, and audio/video.
D. Boxes for hazardous (classified) locations.
E. Floor boxes.
F. Underground boxes/enclosures.

1.02 RELATED REQUIREMENTS

A. Section 03 3000 - Cast-in-Place Concrete.
B. Section 07 8400 - Firestopping.
C. Section 08 3100 - Access Doors and Panels: Panels for maintaining access to concealed boxes.
D. Section 26 0526 - Grounding and Bonding for Electrical Systems.
E. Section 26 0529 - Hangers and Supports for Electrical Systems.
F. Section 26 0533.13 - Conduit for Electrical Systems:
   1. Conduit bodies and other fittings.
   2. Additional requirements for locating boxes to limit conduit length and/or number of bends between pulling points.
G. Section 26 0533.23 - Surface Raceways for Electrical Systems:
H. Section 26 0539 - Underfloor Raceways for Electrical Systems: Junction boxes for underfloor duct systems.
I. Section 26 0553 - Identification for Electrical Systems: Identification products and requirements.
J. Section 26 2726 - Wiring Devices:
   1. Wall plates.
   2. Floor box service fittings.
   3. Poke-through assemblies.
   5. Additional requirements for locating boxes for wiring devices.
K. Section 27 1005 - Structured Cabling for Voice and Data - Inside-Plant: Additional requirements for communications systems outlet boxes.

1.03 REFERENCE STANDARDS

A. NECA 1 - Standard for Good Workmanship in Electrical Construction; 2015.
B. NECA 130 - Standard for Installing and Maintaining Wiring Devices; 2010.
C. NEMA FB 1 - Fittings, Cast Metal Boxes, and Conduit Bodies for Conduit, Electrical Metallic Tubing, and Cable; 2014.
D. NEMA OS 1 - Sheet-Steel Outlet Boxes, Device Boxes, Covers, and Box Supports; 2013.
E. NEMA OS 2 - Nonmetallic Outlet Boxes, Device Boxes, Covers and Box Supports; 2013.
F. NEMA 250 - Enclosures for Electrical Equipment (1000 Volts Maximum); 2014.
G. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.
I. UL 50 - Enclosures for Electrical Equipment, Non-Environmental Considerations; Current Edition, Including All Revisions.
L. UL 514A - Metallic Outlet Boxes; Current Edition, Including All Revisions.
N. UL 1203 - Explosion-Proof and Dust-Ignition-Proof Electrical Equipment for Use in Hazardous (Classified) Locations; Current Edition, Including All Revisions.

1.04 ADMINISTRATIVE REQUIREMENTS
A. Coordination:
   1. Coordinate the work with other trades to avoid placement of ductwork, piping, equipment, or other potential obstructions within the dedicated equipment spaces and working clearances for electrical equipment required by NFPA 70.
   2. Coordinate arrangement of electrical equipment with the dimensions and clearance requirements of the actual equipment to be installed.
   3. Coordinate minimum sizes of boxes with the actual installed arrangement of conductors, clamps, support fittings, and devices, calculated according to NFPA 70.
   4. Coordinate minimum sizes of pull boxes with the actual installed arrangement of connected conduits, calculated according to NFPA 70.
   5. Coordinate the placement of boxes with millwork, furniture, devices, equipment, etc. installed under other sections or by others.
   6. Coordinate the work with other trades to preserve insulation integrity.
   7. Coordinate the work with other trades to provide walls suitable for installation of flush-mounted boxes where indicated.
   8. Notify Architect of any conflicts with or deviations from the contract documents. Obtain direction before proceeding with work.

1.05 SUBMITTALS
A. See Section 01 3000 - Administrative Requirements, for submittal procedures.
B. Product Data: Provide manufacturer's standard catalog pages and data sheets for cabinets and enclosures, boxes for hazardous (classified) locations, floor boxes, and underground boxes/enclosures.
   1. Underground Boxes/Enclosures: Include reports for load testing in accordance with SCTE 77 certified by a professional engineer or an independent testing agency upon request.
C. Samples:
   1. Floor Boxes: Provide one sample(s) of each floor box proposed for substitution upon request.
D. Manufacturer's Installation Instructions: Indicate application conditions and limitations of use stipulated by product testing agency. Include instructions for storage, handling, protection, examination, preparation, and installation of product.
E. Project Record Documents: Record actual locations for outlet and device boxes, pull boxes, cabinets and enclosures, floor boxes, and underground boxes/enclosures.
F. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
   1. See Section 01 6000 - Product Requirements, for additional provisions.
   2. Keys for Lockable Enclosures: Two of each different key.

1.06 QUALITY ASSURANCE
A. Conform to requirements of NFPA 70.
B. Maintain at the project site a copy of each referenced document that prescribes execution requirements.

C. Product Listing Organization Qualifications: An organization recognized by OSHA as a Nationally Recognized Testing Laboratory (NRTL) and acceptable to authorities having jurisdiction.

1.07 DELIVERY, STORAGE, AND HANDLING

A. Receive, inspect, handle, and store products in accordance with manufacturer's instructions.

PART 2 PRODUCTS

2.01 BOXES

A. General Requirements:
   1. Do not use boxes and associated accessories for applications other than as permitted by NFPA 70 and product listing.
   2. Provide all boxes, fittings, supports, and accessories required for a complete raceway system and to accommodate devices and equipment to be installed.
   3. Provide products listed, classified, and labeled as suitable for the purpose intended.
   4. Where box size is not indicated, size to comply with NFPA 70 but not less than applicable minimum size requirements specified.
   5. Provide grounding terminals within boxes where equipment grounding conductors terminate.

B. Outlet and Device Boxes Up to 100 cubic inches (1,650 cu cm), Including Those Used as Junction and Pull Boxes:
   1. Use sheet-steel boxes for dry locations unless otherwise indicated or required.
   2. Use cast iron boxes or cast aluminum boxes for damp or wet locations unless otherwise indicated or required; furnish with compatible weatherproof gasketed covers.
   3. Use cast iron boxes or cast aluminum boxes where exposed galvanized steel rigid metal conduit or exposed intermediate metal conduit (IMC) is used.
   4. Use cast aluminum boxes where aluminum rigid metal conduit is used.
   5. Use nonmetallic boxes where exposed rigid PVC conduit is used.
   6. Use suitable concrete type boxes where flush-mounted in concrete.
   7. Use suitable masonry type boxes where flush-mounted in masonry walls.
   8. Use raised covers suitable for the type of wall construction and device configuration where required.
   9. Use shallow boxes where required by the type of wall construction.
   10. Do not use "through-wall" boxes designed for access from both sides of wall.
   11. Sheet-Steel Boxes: Comply with NEMA OS 1, and list and label as complying with UL 514A.
   12. Cast Metal Boxes: Comply with NEMA FB 1, and list and label as complying with UL 514A; furnish with threaded hubs.
   13. Nonmetallic Boxes: Comply with NEMA OS 2, and list and label as complying with UL 514C.
   14. Boxes for Supporting Luminaires and Ceiling Fans: Listed as suitable for the type and weight of load to be supported; furnished with fixture stud to accommodate mounting of luminaire where required.
   15. Boxes for Ganged Devices: Use multigang boxes of single-piece construction. Do not use field-connected gangable boxes unless specifically indicated or permitted.
   16. Minimum Box Size, Unless Otherwise Indicated:
      a. Wiring Devices (Other Than Communications Systems Outlets): 4 inch square by 1-1/2 inch deep (100 by 38 mm) trade size.
      b. Communications Systems Outlets: 4 inch square by 2-1/8 inch (100 by 54 mm) trade size.
      c. Ceiling Outlets: 4 inch octagonal or square by 1-1/2 inch deep (100 by 38 mm) trade size.
17. Wall Plates: Comply with Section 26 2726.

18. Manufactures:
   b. Hubbell Incorporated; Bell Products; _____: www.hubbell-rtb.com/#sle.
   c. Hubbell Incorporated; RACO Products; _____: www.hubbell-rtb.com/#sle.
   e. Thomas & Betts Corporation; __________: www.tnb.com/#sle.

C. Cabinets and Enclosures, Including Junction and Pull Boxes Larger Than 100 cubic inches (1,650 cu cm):
   1. Comply with NEMA 250, and list and label as complying with UL 50 and UL 50E, or UL 508A.
   2. NEMA 250 Environment Type, Unless Otherwise Indicated:
   3. Junction and Pull Boxes Larger Than 100 cubic inches (1,650 cu cm):
      a. Provide screw-cover or hinged-cover enclosures unless otherwise indicated.
      b. Boxes 6 square feet (0.56 sq m) and Larger: Provide sectionalized screw-cover or hinged-cover enclosures.
   4. Cabinets and Hinged-Cover Enclosures, Other Than Junction and Pull Boxes:
      5. Manufacturers:
         c. Hubbell Incorporated; Wiegmann Products; _____: www.hubbell-wiegmann.com/#sle.
         d. Substitutions: See Section 01 6000 - Product Requirements.

D. Boxes and Enclosures for Integrated Power, Data, and Audio/Video: Size and configuration as indicated or as required with partitions to separate services; field-connected gangable boxes may be used.
   1. Manufacturers:
      b. Substitutions: See Section 01 6000 - Product Requirements.

E. Boxes for Hazardous (Classified) Locations: Listed and labeled as complying with UL 1203 for the classification of the installed location.
   1. Manufacturers:
      d. Substitutions: See Section 01 6000 - Product Requirements.

F. Floor Boxes:
   1. Description: Floor boxes compatible with floor box service fittings provided in accordance with Section 26 2726; with partitions to separate multiple services; furnished with all components, adapters, and trims required for complete installation.
   2. Use cast iron floor boxes within slab on grade.
   3. Use sheet-steel or cast iron floor boxes within slab above grade.
   4. Metallic Floor Boxes: Fully adjustable (with integral means for leveling adjustment prior to and after concrete pour).
   5. Manufacturer: Same as manufacturer of floor box service fittings.

G. Underground Boxes/Enclosures:
   1. Description: In-ground, open bottom boxes furnished with flush, non-skid covers with legend indicating type of service and stainless steel tamper resistant cover bolts.
   2. Size: As indicated on drawings.
3. Depth: As required to extend below frost line to prevent frost upheaval, but not less than 12 inches (300 mm).

4. Applications:
   a. Sidewalks and Landscaped Areas Subject Only to Occasional Nondeliberate Vehicular Traffic: Use polymer concrete enclosures, with minimum SCTE 77, Tier 8 load rating.
   b. Parking Lots, in Areas Subject Only To Occasional Nondeliberate Vehicular Traffic: Use polymer concrete enclosures, with minimum SCTE 77, Tier 15 load rating.
   c. Do not use polymer concrete enclosures in areas subject to deliberate vehicular traffic.

5. Polymer Concrete Underground Boxes/Enclosures: Comply with SCTE 77.
   a. Combination fiberglass/polymer concrete boxes/enclosures are acceptable.

PART 3 EXECUTION

3.01 EXAMINATION
   A. Verify that field measurements are as indicated.
   B. Verify that mounting surfaces are ready to receive boxes.
   C. Verify that conditions are satisfactory for installation prior to starting work.

3.02 INSTALLATION
   A. Install products in accordance with manufacturer’s instructions.
   B. Install boxes in accordance with NECA 1 (general workmanship) and, where applicable, NECA 130, including mounting heights specified in those standards where mounting heights are not indicated.
   C. Arrange equipment to provide minimum clearances in accordance with manufacturer’s instructions and NFPA 70.
   D. Provide separate boxes for emergency power and normal power systems.
   E. Unless otherwise indicated, provide separate boxes for line voltage and low voltage systems.
   F. Flush-mount boxes in finished areas unless specifically indicated to be surface-mounted.
   G. Unless otherwise indicated, boxes may be surface-mounted where exposed conduits are indicated or permitted.
   H. Box Locations:
      1. Locate boxes to be accessible. Provide access panels in accordance with Section 08 3100 as required where approved by the Architect.
      2. Unless dimensioned, box locations indicated are approximate.
      3. Locate boxes as required for devices installed under other sections or by others.
         a. Switches, Receptacles, and Other Wiring Devices: Comply with Section 26 2726.
         b. Communications Systems Outlets: Comply with Section 27 1005.
      4. Locate boxes so that wall plates do not span different building finishes.
      5. Locate boxes so that wall plates do not cross masonry joints.
      6. Unless otherwise indicated, where multiple outlet boxes are installed at the same location at different mounting heights, install along a common vertical center line.
      7. Do not install flush-mounted boxes on opposite sides of walls back-to-back. Provide minimum 6 inches (150 mm) horizontal separation unless otherwise indicated.
      8. Acoustic-Rated Walls: Do not install flush-mounted boxes on opposite sides of walls back-to-back; provide minimum 24 inches (610 mm) horizontal separation.
      9. Fire Resistance Rated Walls: Install flush-mounted boxes such that the required fire resistance will not be reduced.
         a. Do not install flush-mounted boxes on opposite sides of walls back-to-back; provide minimum 24 inches (610 mm) separation where wall is constructed with individual noncommunicating stud cavities or protect both boxes with listed putty pads.
b. Do not install flush-mounted boxes with area larger than 16 square inches (0.0103 sq m) or such that the total aggregate area of openings exceeds 100 square inches (0.0645 sq m) for any 100 square feet (9.29 sq m) of wall area.

10. Locate junction and pull boxes as indicated, as required to facilitate installation of conductors, and to limit conduit length and/or number of bends between pulling points in accordance with Section 26 0533.13.

11. Locate junction and pull boxes in the following areas, unless otherwise indicated or approved by the Architect:
   a. Concealed above accessible suspended ceilings.
   b. Within joists in areas with no ceiling.
   c. Electrical rooms.
   d. Mechanical equipment rooms.

I. Box Supports:
   1. Secure and support boxes in accordance with NFPA 70 and Section 26 0529 using suitable supports and methods approved by the authority having jurisdiction.
   2. Provide independent support from building structure except for cast metal boxes (other than boxes used for fixture support) supported by threaded conduit connections in accordance with NFPA 70. Do not provide support from piping, ductwork, or other systems.
   3. Installation Above Suspended Ceilings: Do not provide support from ceiling grid or ceiling support system.

J. Install boxes plumb and level.

K. Flush-Mounted Boxes:
   1. Install boxes in noncombustible materials such as concrete, tile, gypsum, plaster, etc. so that front edge of box or associated raised cover is not set back from finished surface more than 1/4 inch (6 mm) or does not project beyond finished surface.
   2. Install boxes in combustible materials such as wood so that front edge of box or associated raised cover is flush with finished surface.
   3. Repair rough openings around boxes in noncombustible materials such as concrete, tile, gypsum, plaster, etc. so that there are no gaps or open spaces greater than 1/8 inch (3 mm) at the edge of the box.

L. Install boxes as required to preserve insulation integrity.

M. Metallic Floor Boxes: Install box level at the proper elevation to be flush with finished floor.

N. Nonmetallic Floor Boxes: Cut box flush with finished floor after concrete pour.

O. Underground Boxes/Enclosures:
   1. Install enclosure on gravel base, minimum 6 inches (150 mm) deep.
   2. Install additional bracing inside enclosures in accordance with manufacturer's instructions to minimize box sidewall deflections during backfilling. Backfill with cover bolted in place.

P. Install permanent barrier between ganged wiring devices when voltage between adjacent devices exceeds 300 V.

Q. Install firestopping to preserve fire resistance rating of partitions and other elements, using materials and methods specified in Section 07 8400.

R. Close unused box openings.

S. Install blank wall plates on junction boxes and on outlet boxes with no devices or equipment installed or designated for future use.

T. Provide grounding and bonding in accordance with Section 26 0526.

U. Identify boxes in accordance with Section 26 0553.

3.03 CLEANING
   A. Clean interior of boxes to remove dirt, debris, plaster and other foreign material.
3.04 PROTECTION

A. Immediately after installation, protect boxes from entry of moisture and foreign material until ready for installation of conductors.

END OF SECTION
SECTION 26 0533.23
SURFACE RACEWAYS FOR ELECTRICAL SYSTEMS

PART 1 GENERAL

1.01 SECTION INCLUDES
A. Surface raceway systems.
B. Wireways.

1.02 RELATED REQUIREMENTS
A. Section 26 0526 - Grounding and Bonding for Electrical Systems.
B. Section 26 0529 - Hangers and Supports for Electrical Systems.
   1. Includes metal channel (strut) used as raceway.
C. Section 26 0533.13 - Conduit for Electrical Systems.
D. Section 26 0533.16 - Boxes for Electrical Systems.
E. Section 26 0553 - Identification for Electrical Systems: Identification products and requirements.
F. Section 26 2726 - Wiring Devices: Receptacles.

1.03 REFERENCE STANDARDS
A. NECA 1 - Standard for Good Workmanship in Electrical Construction; 2015.
B. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.
C. NEMA PRP 5 - Installation Guidelines for Surface Nonmetallic Raceway; 2015.
D. UL 5 - Surface Metal Raceways and Fittings; Current Edition, Including All Revisions.
E. UL 5A - Nonmetallic Surface Raceways and Fittings; Current Edition, Including All Revisions.
F. UL 111 - Outline of Investigation for Multioutlet Assemblies; Current Edition, Including All Revisions.

1.04 ADMINISTRATIVE REQUIREMENTS
A. Coordination:
   1. Coordinate the placement of raceways with millwork, furniture, equipment, etc. installed under other sections or by others.
   2. Coordinate rough-in locations of outlet boxes provided under Section 26 0533.16 and conduit provided under Section 26 0533.13 as required for installation of raceways provided under this section.
   3. Verify minimum sizes of raceways with the actual conductors and components to be installed.
   4. Notify Architect of any conflicts with or deviations from the contract documents. Obtain direction before proceeding with work.
B. Sequencing:
   1. Do not install raceways until final surface finishes and painting are complete.
   2. Do not begin installation of conductors and cables until installation of raceways is complete between outlet, junction and splicing points.

1.05 SUBMITTALS
A. See Section 01 3000 - Administrative Requirements, for submittal procedures.
B. Product Data: Provide manufacturer's standard catalog pages and data sheets including dimensions, knockout sizes and locations, materials, fabrication details, finishes, service condition requirements, and accessories.
1. Surface Raceway Systems: Include information on fill capacities for conductors and cables.

C. Shop Drawings:
1. Pre-wired Surface Raceway Systems: Provide plan and elevation views including dimensioned locations of wiring devices and circuiting arrangements.
2. Wireways: Provide dimensioned plan and elevation views including adjacent equipment with all required clearances indicated.

D. Samples: Three of each type and color of surface raceway system specified, 6 inches (150 mm) in length.

1.06 QUALITY ASSURANCE
A. Conform to requirements of NFPA 70.
B. Maintain at the project site a copy of each referenced document that prescribes execution requirements.
C. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years documented experience.
D. Product Listing Organization Qualifications: An organization recognized by OSHA as a Nationally Recognized Testing Laboratory (NRTL) and acceptable to authorities having jurisdiction.

1.07 DELIVERY, STORAGE, AND HANDLING
A. Receive, inspect, handle, and store products in accordance with manufacturer's instructions.

PART 2 PRODUCTS

2.01 RACEWAY REQUIREMENTS
A. Provide all components, fittings, supports, and accessories required for a complete raceway system.
B. Provide products listed, classified, and labeled as suitable for the purpose intended.
C. Do not use raceways for applications other than as permitted by NFPA 70 and product listing.

2.02 SURFACE RACEWAY SYSTEMS
A. Manufacturers:
   3. Wiremold, a brand of Legrand North America, Inc; ______: www.legrand.us/#sle.
   4. Substitutions: See Section 01 6000 - Product Requirements.
B. Surface Metal Raceways: Listed and labeled as complying with UL 5.
C. Surface Nonmetallic Raceways: Listed and labeled as complying with UL 5A.
D. Multioutlet Assemblies: Listed and labeled as complying with UL 111.
E. Metal Channel (Strut) Used as Raceway: Comply with Section 26 0529.

2.03 WIREWAYS
A. Description: Lay-in wireways and wiring troughs with removable covers; listed and labeled as complying with UL 870.
B. Wireway Type, Unless Otherwise Indicated:
C. Where wireway size is not indicated, size to comply with NFPA 70 but not less than applicable minimum size requirements specified.

PART 3 EXECUTION

3.01 EXAMINATION
A. Verify that field measurements are as indicated.
B. Verify that outlet boxes and conduit terminations are installed in proper locations and are properly sized in accordance with NFPA 70 to accommodate raceways.

C. Verify that mounting surfaces are ready to receive raceways and that final surface finishes are complete, including painting.

D. Verify that conditions are satisfactory for installation prior to starting work.

3.02 INSTALLATION

A. Install products in accordance with manufacturer's instructions.

B. Perform work in accordance with NECA 1 (general workmanship).

C. Surface Nonmetallic Raceways: Install in accordance with NEMA PRP 5.

D. Install raceways plumb and level.

E. Arrange wireways and associated raceway connections to comply with NFPA 70, including but not limited to requirements for deflected conductors and wireways used as pullboxes. Increase size of wireway where necessary.

F. Secure and support raceways in accordance with Section 26 0529 at intervals complying with NFPA 70 and manufacturer’s requirements.

G. Close unused raceway openings.

H. Provide grounding and bonding in accordance with Section 26 0526.

I. Identify raceways in accordance with Section 26 0553.

3.03 FIELD QUALITY CONTROL

A. See Section 01 4000 - Quality Requirements, for additional requirements.

B. Inspect raceways for damage and defects.

C. Surface Raceway Systems with Integrated Devices: Test each wiring device to verify operation and proper polarity.

D. Correct wiring deficiencies and replace damaged or defective raceways.

3.04 CLEANING

A. Clean exposed surfaces to remove dirt, paint, or other foreign material and restore to match original factory finish.

END OF SECTION
SECTION 26 0553
IDENTIFICATION FOR ELECTRICAL SYSTEMS

PART 1 GENERAL

1.01 SECTION INCLUDES
   A. Electrical identification requirements.
   B. Identification nameplates and labels.
   C. Wire and cable markers.
   D. Voltage markers.
   E. Underground warning tape.
   F. Floor marking tape.
   G. Warning signs and labels.

1.02 RELATED REQUIREMENTS
   A. Section 09 9113 - Exterior Painting.
   B. Section 09 9123 - Interior Painting.
   C. Section 26 0519 - Low-Voltage Electrical Power Conductors and Cables: Color coding for power conductors and cables 600 V and less; vinyl color coding electrical tape.
   D. Section 26 0536 - Cable Trays for Electrical Systems: Additional identification requirements for cable tray systems.
   E. Section 26 2300 - Low-Voltage Switchgear: Factory-installed mimic bus.

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

1.04 ADMINISTRATIVE REQUIREMENTS
   A. Coordination:
      1. Verify final designations for equipment, systems, and components to be identified prior to fabrication of identification products.
   B. Sequencing:
      1. Do not conceal items to be identified, in locations such as above suspended ceilings, until identification products have been installed.
      2. Do not install identification products until final surface finishes and painting are complete.

1.05 SUBMITTALS
   A. See Section 01 3000 - Administrative Requirements for submittals procedures.
   B. Product Data: Provide manufacturer's standard catalog pages and data sheets for each product.
   C. Shop Drawings: Provide schedule of items to be identified indicating proposed designations, materials, legends, and formats.
   D. Samples:
      1. Identification Nameplates: One of each type and color specified.
   E. Manufacturer's Instructions: Indicate application conditions and limitations of use stipulated by product testing agency. Include instructions for storage, handling, protection, examination, preparation and installation of product.
1.06 QUALITY ASSURANCE
   A. Conform to requirements of NFPA 70.

1.07 FIELD CONDITIONS
   A. Do not install adhesive products when ambient temperature is lower than recommended by manufacturer.

PART 2 PRODUCTS

2.01 IDENTIFICATION REQUIREMENTS
   A. Existing Work: Unless specifically excluded, identify existing elements to remain that are not already identified in accordance with specified requirements.

   B. Identification for Equipment:
      1. Use identification nameplate to identify each piece of electrical distribution and control equipment and associated sections, compartments, and components.
         a. Switchgear:
            1) Identify ampere rating.
            2) Identify voltage and phase.
            3) Identify power source and circuit number. Include location when not within sight of equipment.
            4) Use identification nameplate to identify main and tie devices.
            5) Use identification nameplate to identify load(s) served for each branch device. Do not identify spares and spaces.
            6) See Section 26 2300 for factory-installed mimic bus.
         b. Switchboards:
            1) Identify ampere rating.
            2) Identify voltage and phase.
            3) Identify power source and circuit number. Include location when not within sight of equipment.
            4) Use identification nameplate to identify main overcurrent protective device.
            5) Use identification nameplate to identify load(s) served for each branch device. Do not identify spares and spaces.
         c. Panelboards:
            1) Identify ampere rating.
            2) Identify voltage and phase.
            3) Identify power source and circuit number. Include location when not within sight of equipment.
            4) Identify main overcurrent protective device. Use identification label for panelboards with a door. For power distribution panelboards without a door, use identification nameplate.
            5) Use typewritten circuit directory to identify load(s) served for panelboards with a door. Identify spares and spaces using pencil.
            6) For power panelboards without a door, use identification nameplate to identify load(s) served for each branch device. Do not identify spares and spaces.
         d. Transformers:
            1) Identify kVA rating.
            2) Identify voltage and phase for primary and secondary.
            3) Identify power source and circuit number. Include location when not within sight of equipment.
            4) Identify load(s) served. Include location when not within sight of equipment.
         e. Enclosed switches, circuit breakers, and motor controllers:
            1) Identify voltage and phase.
            2) Identify power source and circuit number. Include location when not within sight of equipment.
            3) Identify load(s) served. Include location when not within sight of equipment.
f. Transfer Switches:
   1) Identify voltage and phase.
   2) Identify power source and circuit number for both normal power source and standby power source. Include location when not within sight of equipment.
   3) Identify load(s) served. Include location when not within sight of equipment.
   4) Identify short circuit current rating based on the specific overcurrent protective device type and settings protecting the transfer switch.

g. Electricity Meters:
   1) Identify load(s) metered.

2. Service Equipment:
   a. Use identification nameplate to identify each service disconnecting means.
   b. For buildings or structures supplied by more than one service, or any combination of branch circuits, feeders, and services, use identification nameplate or means of identification acceptable to authority having jurisdiction at each service disconnecting means to identify all other services, feeders, and branch circuits supplying that building or structure. Verify format and descriptions with authority having jurisdiction.

3. Emergency System Equipment:
   a. Use identification nameplate or voltage marker to identify emergency system equipment in accordance with NFPA 70.
   b. Use identification nameplate at each piece of service equipment to identify type and location of on-site emergency power sources.
   c. Use identification nameplate to identify emergency operating instructions for emergency system equipment.

4. Use voltage marker to identify highest voltage present for each piece of electrical equipment.

5. Use identification nameplate to identify equipment utilizing series ratings, where permitted, in accordance with NFPA 70.

6. Use identification nameplate to identify switchboards and panelboards utilizing a high leg delta system in accordance with NFPA 70.

7. Available Fault Current Documentation: Use identification label to identify the available fault current and date calculations were performed at locations requiring documentation by NFPA 70, including but not limited to the following.
   a. Service equipment.
   b. Industrial control panels.
   c. Motor control centers.
   d. Elevator control panels.
   e. Industrial machinery.

8. Arc Flash Hazard Warning Labels: Use warning labels to identify arc flash hazards for electrical equipment, such as switchboards, panelboards, industrial control panels, meter socket enclosures, and motor control centers that are likely to require examination, adjustment, servicing, or maintenance while energized.
   a. Minimum Size: 3.5 by 5 inches (89 mm by 127 mm).
   b. Legend: Include orange header that reads "WARNING", followed by the word message "Arc Flash and Shock Hazard; Appropriate PPE Required; Do not operate controls or open covers without appropriate personal protection equipment; Failure to comply may result in injury or death; Refer to NFPA 70E for minimum PPE requirements" or approved equivalent.
   c. Service Equipment: Include the following information in accordance with NFPA 70.
      1) Nominal system voltage.
      2) Available fault current.
      3) Clearing time of service overcurrent protective device(s).
      4) Date label applied.

9. Use warning signs to identify electrical hazards for entrances to all rooms and other guarded locations that contain exposed live parts operating at 600 V nominal or less with
the word message "DANGER; Electrical hazard; Authorized personnel only" or approved equivalent.

10. Use warning signs to identify electrical hazards for entrances to all buildings, vaults, rooms, or enclosures containing exposed live parts or exposed conductors operating at over 600 V nominal with the word message "DANGER; HIGH VOLTAGE; KEEP OUT".

11. Use warning labels to identify electrical hazards for equipment, compartments, and enclosures containing exposed live parts or exposed conductors operating at over 600 V nominal with the word message "DANGER; HIGH VOLTAGE; KEEP OUT".

12. Use warning labels, identification nameplates, or identification labels to identify electrical hazards for equipment where multiple power sources are present with the word message "DANGER; Hazardous voltage; Multiple power sources may be present; Disconnect all electric power including remote disconnects before servicing" or approved equivalent.

C. Identification for Conductors and Cables:

1. Color Coding for Power Conductors 600 V and Less: Comply with Section 26 0519.

2. Use identification nameplate or identification label to identify color code for ungrounded and grounded power conductors inside door or enclosure at each piece of feeder or branch-circuit distribution equipment when premises has feeders or branch circuits served by more than one nominal voltage system.

3. Use wire and cable markers to identify circuit number or other designation indicated for power, control, and instrumentation conductors and cables at the following locations:
   a. At each source and load connection.
   b. Within boxes when more than one circuit is present.
   c. Within equipment enclosures when conductors and cables enter or leave the enclosure.
   d. In cable tray, at maximum intervals of 20 feet (6.1 m).

4. Use wire and cable markers to identify connected grounding electrode system components for grounding electrode conductors.

5. Use underground warning tape to identify direct buried cables.

D. Identification for Raceways:

1. Use voltage markers to identify highest voltage present for accessible conduits at maximum intervals of 20 feet (6.1 m).

2. Use voltage markers or color-coded bands to identify systems other than normal power system for accessible conduits at maximum intervals of 20 feet (6.1 m).
   a. Color-Coded Bands: Use field-painting or vinyl color coding electrical tape to mark bands 3 inches (76 mm) wide.
      1) Color Code:
         (a) Emergency Power System: Red.
         (b) Fire Alarm System: Red.
      2) Field-Painting: Comply with Section 09 9123 and 09 9113.
      3) Vinyl Color Coding Electrical Tape: Comply with Section 26 0519.

2.02 IDENTIFICATION NAMEPLATES AND LABELS

A. Identification Nameplates:

1. Materials:

2. Mounting Holes for Mechanical Fasteners: Two, centered on sides for sizes up to 1 inch (25 mm) high; Four, located at corners for larger sizes.

B. Identification Labels:

1. Materials: Use self-adhesive laminated plastic labels; UV, chemical, water, heat, and abrasion resistant.

2. Text: Use factory pre-printed or machine-printed text. Do not use handwritten text unless otherwise indicated.

C. Format for Equipment Identification:

1. Minimum Size: 1 inch (25 mm) by 2.5 inches (64 mm).

2. Legend:
a. System designation where applicable:
   1) Emergency Power System: Identify with text "EMERGENCY".
   2) Fire Alarm System: Identify with text "FIRE ALARM".

b. Equipment designation or other approved description.

c. Other information as indicated.

3. Text: All capitalized unless otherwise indicated.

4. Minimum Text Height:
   a. System Designation: 1 inch (25 mm).
   b. Equipment Designation: 1/2 inch (13 mm).
   c. Other Information: 1/4 inch (6 mm).

5. Color:

D. Format for General Information and Operating Instructions:
   1. Minimum Size: 1 inch (25 mm) by 2.5 inches (64 mm).
   2. Legend: Include information or instructions indicated or as required for proper and safe operation and maintenance.
   3. Text: All capitalized unless otherwise indicated.
   4. Minimum Text Height: 1/4 inch (6 mm).
   5. Color: Black text on white background unless otherwise indicated.

E. Format for Caution and Warning Messages:
   1. Minimum Size: 2 inches (51 mm) by 4 inches (100 mm).
   2. Legend: Include information or instructions indicated or as required for proper and safe operation and maintenance.
   3. Text: All capitalized unless otherwise indicated.
   4. Minimum Text Height: 1/2 inch (13 mm).
   5. Color: Black text on yellow background unless otherwise indicated.

2.03 WIRE AND CABLE MARKERS

A. Manufacturers:
   2. HellermannTyton; ______: www.hellermanntyton.com/#sle.
   4. Substitutions: See Section 01 6000 - Product Requirements.

B. Markers for Conductors and Cables: Use wrap-around self-adhesive vinyl cloth, wrap-around self-adhesive vinyl self-laminating, heat-shrink sleeve, plastic sleeve, plastic clip-on, or vinyl split sleeve type markers suitable for the conductor or cable to be identified.

C. Markers for Conductor and Cable Bundles: Use plastic marker tags secured by nylon cable ties.

D. Legend: Power source and circuit number or other designation indicated.

E. Text: Use factory pre-printed or machine-printed text, all capitalized unless otherwise indicated.

F. Minimum Text Height: 1/8 inch (3 mm).

G. Color: Black text on white background unless otherwise indicated.

2.04 VOLTAGE MARKERS

A. Manufacturers:

B. Markers for Conduits: Use factory pre-printed self-adhesive vinyl, self-adhesive vinyl cloth, or vinyl snap-around type markers.

C. Markers for Boxes and Equipment Enclosures: Use factory pre-printed self-adhesive vinyl or self-adhesive vinyl cloth type markers.
D. Minimum Size:
   1. Markers for Equipment: 1 1/8 by 4 1/2 inches (29 by 110 mm).
   2. Markers for Conduits: As recommended by manufacturer for conduit size to be identified.

E. Legend:
   1. Markers for Voltage Identification: Highest voltage present.
   2. Markers for System Identification:
      a. Emergency Power System: Text "EMERGENCY".
      b. Other Systems: Type of service.

F. Color: Black text on orange background unless otherwise indicated.

2.05 UNDERGROUND WARNING TAPE

A. Manufacturers:
   4. Substitutions: See Section 01 6000 - Product Requirements.

B. Materials: Use non-detectable type polyethylene tape suitable for direct burial, unless otherwise indicated.

C. Non-detectable Type Tape: 6 inches (152 mm) wide, with minimum thickness of 4 mil (0.1 mm).

D. Foil-backed Detectable Type Tape: 3 inches (76 mm) wide, with minimum thickness of 5 mil (0.1 mm), unless otherwise required for proper detection.

E. Legend: Type of service, continuously repeated over full length of tape.

F. Color:
   1. Tape for Buried Power Lines: Black text on red background.

2.06 FLOOR MARKING TAPE

A. Manufacturers:
   4. Substitutions: See Section 01 6000 - Product Requirements.

B. Floor Marking Tape for Equipment Working Clearance Identification: Self-adhesive vinyl or polyester tape with overlaminate, 3 inches (76 mm) wide, with alternating black and white stripes.

2.07 WARNING SIGNS AND LABELS

A. Manufacturers:
   4. Substitutions: See Section 01 6000 - Product Requirements.

B. Comply with ANSI Z535.2 or ANSI Z535.4 as applicable.

C. Warning Signs:
   1. Materials:
   2. Rigid Signs: Provide four mounting holes at corners for mechanical fasteners.
   3. Minimum Size: 7 by 10 inches (178 by 254 mm) unless otherwise indicated.

D. Warning Labels:
1. **Materials:** Use factory pre-printed or machine-printed self-adhesive polyester or self-adhesive vinyl labels; UV, chemical, water, heat, and abrasion resistant; produced using materials recognized to UL 969.
   a. Do not use labels designed to be completed using handwritten text.
2. **Machine-Printed Labels:** Use thermal transfer process printing machines and accessories recommended by label manufacturer.
3. Minimum Size: 2 by 4 inches (51 mm by 102 mm) unless otherwise indicated.

### PART 3 EXECUTION

#### 3.01 PREPARATION

A. Clean surfaces to receive adhesive products according to manufacturer's instructions.

#### 3.02 INSTALLATION

A. Install products in accordance with manufacturer's instructions.
B. Install identification products to be plainly visible for examination, adjustment, servicing, and maintenance. Unless otherwise indicated, locate products as follows:
   1. **Surface-Mounted Equipment:** Enclosure front.
   2. **Flush-Mounted Equipment:** Inside of equipment door.
   3. **Free-Standing Equipment:** Enclosure front; also enclosure rear for equipment with rear access.
   4. **Elevated Equipment:** Legible from the floor or working platform.
   5. **Branch Devices:** Adjacent to device.
   6. **Interior Components:** Legible from the point of access.
   7. **Conduits:** Legible from the floor.
   8. **Boxes:** Outside face of cover.
   9. **Conductors and Cables:** Legible from the point of access.
   10. **Devices:** Outside face of cover.
C. Install identification products centered, level, and parallel with lines of item being identified.
D. Secure nameplates to exterior surfaces of enclosures using stainless steel screws and to interior surfaces using self-adhesive backing or epoxy cement.
   1. Do not use adhesives on exterior surfaces except where substrate cannot be penetrated.
E. Install self-adhesive labels and markers to achieve maximum adhesion, with no bubbles or wrinkles and edges properly sealed.
F. Install underground warning tape above buried lines with one tape per trench at 3 inches (75 mm) below finished grade.
G. Secure rigid signs using stainless steel screws.
H. Mark all handwritten text, where permitted, to be neat and legible.

#### 3.03 FIELD QUALITY CONTROL

A. See Section 01 4000 - Quality Requirements, for additional requirements.
B. Replace self-adhesive labels and markers that exhibit bubbles, wrinkles, curling or other signs of improper adhesion.

END OF SECTION
SECTION 26 0583
WIRING CONNECTIONS

PART 1  GENERAL

1.01 SECTION INCLUDES
A. Electrical connections to equipment.

1.02 RELATED REQUIREMENTS
A. Section 26 0519 - Low-Voltage Electrical Power Conductors and Cables.
B. Section 26 0533.13 - Conduit for Electrical Systems.
C. Section 26 0533.16 - Boxes for Electrical Systems.
D. Section 26 2726 - Wiring Devices.
E. Section 26 2816.16 - Enclosed Switches.

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

1.04 ADMINISTRATIVE REQUIREMENTS
A. Coordination:
   1. Obtain and review shop drawings, product data, manufacturer’s wiring diagrams, and manufacturer’s instructions for equipment furnished under other sections.
   2. Determine connection locations and requirements.
B. Sequencing:
   1. Install rough-in of electrical connections before installation of equipment is required.
   2. Make electrical connections before required start-up of equipment.

1.05 SUBMITTALS
A. See Section 01 3000 - Administrative Requirements, for submittal procedures.
B. Product Data: Provide wiring device manufacturer’s catalog information showing dimensions, configurations, and construction.
C. Manufacturer’s Instructions: Indicate application conditions and limitations of use stipulated by product testing agency. Include instructions for storage, handling, protection, examination, preparation, and installation of product.

1.06 QUALITY ASSURANCE
A. Conform to requirements of NFPA 70.
B. Products: Listed, classified, and labeled as suitable for the purpose intended.
C. Product Listing Organization Qualifications: An organization recognized by OSHA as a Nationally Recognized Testing Laboratory (NRTL) and acceptable to authorities having jurisdiction.

PART 2  PRODUCTS

2.01 MATERIALS

2.02 EQUIPMENT CONNECTIONS

PART 3  EXECUTION

3.01 EXAMINATION
A. Verify that equipment is ready for electrical connection, wiring, and energization.

3.02 ELECTRICAL CONNECTIONS
A. Make electrical connections in accordance with equipment manufacturer’s instructions.
B. Make conduit connections to equipment using flexible conduit. Use liquidtight flexible conduit with watertight connectors in damp or wet locations.

C. Connect heat producing equipment using wire and cable with insulation suitable for temperatures encountered.

D. Provide receptacle outlet to accommodate connection with attachment plug.

E. Provide cord and cap where field-supplied attachment plug is required.

F. Install suitable strain-relief clamps and fittings for cord connections at outlet boxes and equipment connection boxes.

G. Install disconnect switches, controllers, control stations, and control devices to complete equipment wiring requirements.

H. Install terminal block jumpers to complete equipment wiring requirements.

I. Install interconnecting conduit and wiring between devices and equipment to complete equipment wiring requirements.

J. Coolers and Freezers: Cut and seal conduit openings in freezer and cooler walls, floor, and ceilings.

END OF SECTION
SECTION 26 0923
LIGHTING CONTROL DEVICES

PART 1  GENERAL

1.01  SECTION INCLUDES
A. Occupancy sensors.
B. Outdoor motion sensors.
C. Time switches.
D. Outdoor photo controls.
E. Lighting contactors.
F. Control accessories.

1.02  RELATED REQUIREMENTS
A. Section 26 0526 - Grounding and Bonding for Electrical Systems.
B. Section 26 0529 - Hangers and Supports for Electrical Systems.
C. Section 26 0533.16 - Boxes for Electrical Systems.
D. Section 26 0553 - Identification for Electrical Systems: Identification products and requirements.
E. Section 26 0573 - Power System Studies.
F. Section 26 0918 - Remote Control Switching Devices: Remotely controlled devices for lighting control, including networked lighting controls, programmable relay panels, and remote control switching relays.
G. Section 26 2726 - Wiring Devices: Devices for manual control of lighting, including wall switches, wall dimmers, and fan speed controllers.
H. Section 26 5100 - Interior Lighting.
I. Section 26 5113 - Luminaires, Ballasts, and Drivers - Lutron.
J. Section 26 5600 - Exterior Lighting.

1.03  REFERENCE STANDARDS
B. NECA 1 - Standard for Good Workmanship in Electrical Construction; 2015.
C. NECA 130 - Standard for Installing and Maintaining Wiring Devices; 2010.
D. NEMA 250 - Enclosures for Electrical Equipment (1000 Volts Maximum); 2014.
E. NEMA 410 - Performance Testing for Lighting Controls and Switching Devices with Electronic Drivers and Discharge Ballasts; 2016.
H. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.
J. UL 1472 - Solid-State Dimming Controls; Current Edition, Including All Revisions.
UNITED STATES OF AMERICA

HARRIS COUNTY AIRPORT

PROJECT NO.: 103620

HAMPTON, GA

SBE PROJECT NO.: 18070

LIGHTING CONTROL DEVICES

1.04 ADMINISTRATIVE REQUIREMENTS

A. Coordination:
   1. Coordinate the placement of lighting control devices with millwork, furniture, equipment, etc. installed under other sections or by others.
   2. Coordinate the placement of wall switch occupancy sensors with actual installed door swings.
   3. Coordinate the placement of occupancy sensors with millwork, furniture, equipment or other potential obstructions to motion detection coverage installed under other sections or by others.
   4. Coordinate the placement of photo sensors for daylighting controls with windows, skylights, and luminaires to achieve optimum operation. Coordinate placement with ductwork, piping, equipment, or other potential obstructions to light level measurement installed under other sections or by others.
   5. Notify Architect of any conflicts or deviations from the contract documents to obtain direction prior to proceeding with work.

1.05 SUBMITTALS

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

B. Product Data: Include ratings, configurations, standard wiring diagrams, dimensions, colors, service condition requirements, and installed features.
   1. Occupancy Sensors: Include detailed motion detection coverage range diagrams.

C. Shop Drawings:
   1. Occupancy Sensors: Provide lighting plan indicating location, model number, and orientation of each occupancy sensor and associated system component.

D. Field Quality Control Reports.

E. Project Record Documents: Record actual installed locations and settings for lighting control devices.

1.06 QUALITY ASSURANCE

A. Conform to requirements of NFPA 70.

1.07 DELIVERY, STORAGE, AND PROTECTION

A. Store products in a clean, dry space in original manufacturer's packaging in accordance with manufacturer's written instructions until ready for installation.

1.08 FIELD CONDITIONS

A. Maintain field conditions within manufacturer's required service conditions during and after installation.

1.09 WARRANTY

A. See Section 01 7800 - Closeout Submittals, for additional warranty requirements.

B. Provide five year manufacturer warranty for all occupancy sensors.

PART 2 PRODUCTS

2.01 LIGHTING CONTROL DEVICES - GENERAL REQUIREMENTS

A. Provide products listed, classified, and labeled as suitable for the purpose intended.

B. Unless specifically indicated to be excluded, provide all required conduit, wiring, connectors, hardware, components, accessories, etc. as required for a complete operating system.

C. Products for Switching of Electronic Ballasts/Drivers: Tested and rated to be suitable for peak inrush currents specified in NEMA 410.
# 2.02 OCCUPANCY SENSORS

## A. Manufacturers:

5. Substitutions: See Section 01 6000 - Product Requirements.

## B. All Occupancy Sensors:

1. **Description:** Factory-assembled commercial specification grade devices for indoor use capable of sensing both major motion, such as walking, and minor motion, such as small desktop level movements, according to published coverage areas, for automatic control of load indicated.
2. **Sensor Technology:**
   a. Passive Infrared (PIR) Occupancy Sensors: Designed to detect occupancy by sensing movement of thermal energy between zones.
   b. Ultrasonic Occupancy Sensors: Designed to detect occupancy by sensing frequency shifts in emitted and reflected inaudible sound waves.
   c. Passive Infrared/Ultrasonic Dual Technology Occupancy Sensors: Designed to detect occupancy using a combination of both passive infrared and ultrasonic technologies.
3. **Provide LED to visually indicate motion detection with separate color LEDs for each sensor type in dual technology units.**
4. **Operation:** Unless otherwise indicated, occupancy sensor to turn load on when occupant presence is detected and to turn load off when no occupant presence is detected during an adjustable turn-off delay time interval.
5. **Dual Technology Occupancy Sensors:** Field configurable turn-on and hold-on activation with settings for activation by either or both sensing technologies.
6. **Turn-Off Delay:** Field adjustable, with time delay settings up to 30 minutes.
7. **Sensitivity:** Field adjustable.
8. **Adaptive Technology:** Field selectable; capable of self-adjusting sensitivity and time delay according to conditions.
9. **Integral Photocell:** For field selectable and adjustable inhibition of automatic turn-on of load when ambient lighting is above the selected level.
10. **Compatibility (Non-Dimming Sensors):** Suitable for controlling incandescent lighting, low-voltage lighting with electronic and magnetic transformers, fluorescent lighting with electronic and magnetic ballasts, and fractional motor loads, with no minimum load requirements.
11. **Load Rating for Line Voltage Occupancy Sensors:** As required to control the load indicated on drawings.

## C. Wall Switch Occupancy Sensors:

1. **All Wall Switch Occupancy Sensors:**
   a. **Description:** Occupancy sensors designed for installation in standard wall box at standard wall switch mounting height with a field of view of 180 degrees, integrated manual control capability, and no leakage current to load in off mode.
   b. **Manual-Off Override Control:** When used to turn off load while in automatic-on mode, unit to revert back to automatic mode after no occupant presence is detected during the delayed-off time interval.
2. **Passive Infrared (PIR) Wall Switch Occupancy Sensors:** Capable of detecting motion within an area of 900 square feet (83.6 sq m).
3. **Ultrasonic Wall Switch Occupancy Sensors:** Capable of detecting motion within an area of 400 square feet (37.2 sq m).
4. **Passive Infrared/Ultrasonic Dual Technology Wall Switch Occupancy Sensors:** Capable of detecting motion within an area of 900 square feet (83.6 sq m).
D. Wall Dimmer Occupancy Sensors:
   1. General Requirements:
      a. Description: Occupancy sensors designed for installation in standard wall box at
         standard wall switch mounting height with a field of view of 180 degrees, integrated
         dimming control capability, and no leakage current to load in off mode.
      b. Dimmer: Solid-state with continuous full-range even control following square law
         dimming curve, integral radio frequency interference filtering, power failure preset
         memory, air gap switch accessible without removing wall plate, and listed as
         complying with UL 1472; type and rating suitable for load controlled.
   2. Passive Infrared (PIR) Wall Dimmer Occupancy Sensors: Capable of detecting motion
      within an area of 900 square feet (83.6 sq m).

E. Ceiling Mounted Occupancy Sensors:
   1. All Ceiling Mounted Occupancy Sensors:
      a. Description: Low profile occupancy sensors designed for ceiling installation.
   2. Passive Infrared (PIR) Ceiling Mounted Occupancy Sensors:

F. Directional Occupancy Sensors:
   1. All Directional Occupancy Sensors: Designed for wall or ceiling mounting, with integral
      swivel for field adjustment of motion detection coverage.

G. Power Packs for Wireless Occupancy Sensors:
   1. Description: Plenum rated, self-contained relay compatible with specified wireless
      occupancy sensors for switching of line voltage loads.
   2. Input Supply Voltage: Dual rated for 120/277 V ac.

2.03 OUTDOOR MOTION SENSORS

A. Manufacturers:
   2. Lithonia Lighting; __________: www.lithonia.com/#sle.
   4. Substitutions: See Section 01 6000 - Product Requirements.

B. Description: Factory-assembled wet location listed device suitable for wall or ceiling/eave
   mounting, with integral swivel for field adjustment of coverage, capable of detecting motion for
   automatic control of load indicated.

C. Sensor Technology: Passive Infrared (PIR) designed to detect occupancy by sensing
   movement of thermal energy between zones.

D. Operation: Unless otherwise indicated, motion sensor to turn load on when motion is detected
   and to turn load off when no motion is detected during an adjustable turn-off delay time interval.

E. Turn-Off Delay: Field adjustable, with time delay settings available up to 15 minutes.

F. Integral Photocell: For dusk to dawn operation.

G. Manual Override: Activated by switching power off to unit and then back on.

H. Load Rating: 1,000 W incandescent and fluorescent load at 120 V ac.

I. Coverage: Capable of detecting motion within a distance of 50 feet (15 m) at a mounting height
   of 8 feet (2.4 m), with a field of view of 270 degrees.

2.04 TIME SWITCHES

2.05 OUTDOOR PHOTO CONTROLS

A. Manufacturers:
   1. Intermatic, Inc; __________: www.intermatic.com/#sle.
   2. Tork, a division of NSI Industries LLC; __________: www.tork.com/#sle.
   3. Substitutions: See Section 01 6000 - Product Requirements.

B. Stem-Mounted Outdoor Photo Controls:
1. **Description:** Direct-wired photo control unit with threaded conduit mounting stem and field-adjustable swivel base, listed and labeled as complying with UL 773A.
2. **Housing:** Weatherproof, impact resistant polycarbonate.
3. **Photo Sensor:** Cadmium sulfide.
4. **Provide external sliding shield for field adjustment of light level activation.**
5. **Light Level Activation:** 1 to 5 footcandles (10.8 to 53.8 lux) turn-on and 3 to 1 turn-off to turn-on ratio with delayed turn-off.
6. **Voltage:** As required to control the load indicated on the drawings.
7. **Failure Mode:** Fails to the on position.
8. **Load Rating:** As required to control the load indicated on the drawings.

**C. Button Type Outdoor Photo Controls**

1. **Description:** Direct-wired photo control unit complying with ANSI C136.24 with weatherproof gasketed wall plate where required or indicated, listed and labeled as complying with UL 773A.
2. **Housing:** Weather resistant polycarbonate.
3. **Photo Sensor:** Cadmium sulfide.
4. **Light Level Activation:** 1 to 3 footcandles (10.8 to 32.3 lux) turn-on and 3 to 1 turn-off to turn-on ratio with delayed turn-off.
5. **Voltage:** As required to control the load indicated on the drawings.
6. **Failure Mode:** Fails to the on position.
7. **Load Rating:** As required to control the load indicated on the drawings.

### 2.06 LIGHTING CONTACTORS

**A. Manufacturers:**

3. Rockwell Automation Inc; Allen-Bradley Products; [ab.rockwellautomation.com/#sle](http://ab.rockwellautomation.com/#sle).
4. Schneider Electric; Square D Products; [www.schneider-electric.us/#sle](http://www.schneider-electric.us/#sle).
6. Substitutions: See Section 01 6000 - Product Requirements.

**B. Description:** Magnetic lighting contactors complying with NEMA ICS 2, and listed and labeled as complying with UL 60947-1 and UL 60947-4-1; noncombination type unless otherwise indicated; ratings, configurations and features as indicated on the drawings.

**C. Short Circuit Current Rating:**

**D. Enclosures:**

2. Environment Type per NEMA 250: Unless otherwise indicated, as specified for the following installation locations:
3. Finish: Manufacturer's standard unless otherwise indicated.

### PART 3 EXECUTION

**3.01 EXAMINATION**

**A.** Verify that field measurements are as indicated.

**B.** Verify that outlet boxes are installed in proper locations and at proper mounting heights and are properly sized to accommodate devices and conductors in accordance with NFPA 70.

**C.** Verify that openings for outlet boxes are neatly cut and will be completely covered by devices or wall plates.

**D.** Verify that final surface finishes are complete, including painting.

**E.** Verify that branch circuit wiring installation is completed, tested, and ready for connection to lighting control devices.
3.02 PREPARATION
A. Provide extension rings to bring outlet boxes flush with finished surface.
B. Clean dirt, debris, plaster, and other foreign materials from outlet boxes.

3.03 INSTALLATION
A. Install lighting control devices in accordance with NECA 1 (general workmanship) and, where applicable, NECA 130, including mounting heights specified in those standards unless otherwise indicated.
B. Coordinate locations of outlet boxes provided under Section 26 0533.16 as required for installation of lighting control devices provided under this section.
   1. Mounting Heights: Unless otherwise indicated, as follows:
      a. Wall Switch Occupancy Sensors: 48 inches (1.2 m) above finished floor.
      b. In-Wall Time Switches: 48 inches (1.2 m) above finished floor.
      c. In-Wall Interval Timers: 48 inches (1.2 m) above finished floor.
   2. Orient outlet boxes for vertical installation of lighting control devices unless otherwise indicated.
   3. Locate wall switch occupancy sensors on strike side of door with edge of wall plate 3 inches (80 mm) from edge of door frame. Where locations are indicated otherwise, notify Architect to obtain direction prior to proceeding with work.
C. Install lighting control devices in accordance with manufacturer's instructions.
D. Unless otherwise indicated, connect lighting control device grounding terminal or conductor to branch circuit equipment grounding conductor and to outlet box with bonding jumper.
E. Install lighting control devices plumb and level, and held securely in place.
F. Where required and not furnished with lighting control device, provide wall plate in accordance with Section 26 2726.
G. Provide required supports in accordance with Section 26 0529.
H. Where applicable, install lighting control devices and associated wall plates to fit completely flush to mounting surface with no gaps and rough opening completely covered without strain on wall plate. Repair or reinstall improperly installed outlet boxes or improperly sized rough openings. Do not use oversized wall plates in lieu of meeting this requirement.
I. Identify lighting control devices in accordance with Section 26 0553.
J. Occupancy Sensor Locations:
   1. Location Adjustments: Locations indicated are diagrammatic and only intended to indicate which rooms or areas require devices. Provide quantity and locations as required for complete coverage of respective room or area based on manufacturer's recommendations for installed devices.
   2. Locate ultrasonic and dual technology passive infrared/ultrasonic occupancy sensors a minimum of 4 feet (1.2 m) from air supply ducts or other sources of heavy air flow and as per manufacturer's recommendations, in order to minimize false triggers.
K. Outdoor Photo Control Locations:
   1. Where possible, locate outdoor photo controls with photo sensor facing north. If north facing photo sensor is not possible, install with photo sensor facing east, west, or down.
   2. Locate outdoor photo controls so that photo sensors do not face artificial light sources, including light sources controlled by the photo control itself.
L. Install outdoor photo controls so that connections are weatherproof. Do not install photo controls with conduit stem facing up in order to prevent infiltration of water into the photo control.
3.04 FIELD QUALITY CONTROL
   A. See Section 01 4000 - Quality Requirements, for additional requirements.
   B. Inspect each lighting control device for damage and defects.
   C. Test occupancy sensors to verify proper operation, including time delays and ambient light thresholds where applicable. Verify optimal coverage for entire room or area. Record test results in written report to be included with submittals.
   D. Test time switches to verify proper operation.
   E. Test outdoor photo controls to verify proper operation, including time delays where applicable.
   F. Correct wiring deficiencies and replace damaged or defective lighting control devices.

3.05 ADJUSTING
   A. Adjust devices and wall plates to be flush and level.
   B. Adjust occupancy sensor settings to minimize undesired activations while optimizing energy savings, and to achieve desired function as indicated or as directed by Architect.
   C. Adjust position of directional occupancy sensors and outdoor motion sensors to achieve optimal coverage as required.
   D. Where indicated or as directed by Architect, install factory masking material or adjust integral blinders on passive infrared (PIR) and dual technology occupancy sensor lenses to block undesired motion detection.
   E. Adjust time switch settings to achieve desired operation schedule as indicated or as directed by Architect. Record settings in written report to be included with submittals.
   F. Adjust external sliding shields on outdoor photo controls under optimum lighting conditions to achieve desired turn-on and turn-off activation as indicated or as directed by Architect.

3.06 CLEANING
   A. Clean exposed surfaces to remove dirt, paint, or other foreign material and restore to match original factory finish.

3.07 COMMISSIONING
   A. See Section 01 9113 - General Commissioning Requirements for commissioning requirements.

3.08 CLOSEOUT ACTIVITIES

END OF SECTION
SECTION 26 2100
LOW-VOLTAGE ELECTRICAL SERVICE ENTRANCE

PART 1  GENERAL
1.01  SECTION INCLUDES
   A. Electrical service requirements.

1.02  RELATED REQUIREMENTS
   A. Section 03 3000 - Cast-in-Place Concrete: Materials and installation requirements for cast-in-place concrete equipment pads.
   B. Section 26 0519 - Low-Voltage Electrical Power Conductors and Cables.
   C. Section 26 0526 - Grounding and Bonding for Electrical Systems.
   D. Section 26 0529 - Hangers and Supports for Electrical Systems.
   E. Section 26 0533.13 - Conduit for Electrical Systems.
   F. Section 26 0533.23 - Surface Raceways for Electrical Systems: Wireways.
   G. Section 26 0553 - Identification for Electrical Systems: Identification products and requirements.
   H. Section 26 2300 - Low-Voltage Switchgear: Service entrance equipment.
      1. Includes non-utility electrical metering.
   I. Section 26 2413 - Switchboards: Service entrance equipment.
      1. Includes non-utility electrical metering.
   J. Section 26 2416 - Panelboards: Service entrance equipment.
   K. Section 26 2713 - Electricity Metering: Non-utility electrical metering.
   L. Section 26 2816.16 - Enclosed Switches: Service entrance equipment.
   M. Section 26 3213 - Engine Generators: Emergency/standby power systems for interconnection with normal utility electrical supply.
   N. Section 26 3600 - Transfer Switches: Service entrance equipment.
   O. Section 26 4300 - Surge Protective Devices: Service entrance surge protective devices.
   P. Section 31 2316.13 - Trenching: Excavating, bedding, and backfilling.

1.03  REFERENCE STANDARDS
   B. NECA 1 - Standard for Good Workmanship in Electrical Construction; 2015.
   C. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

1.04  ADMINISTRATIVE REQUIREMENTS
   A. No later than two weeks following date of the Agreement, notify Utility Company of anticipated date of service.
   B. Coordination:
      1. Verify the following with Utility Company representative:
         a. Utility Company requirements, including division of responsibility.
         b. Exact location and details of utility point of connection.
         c. Utility easement requirements.
         d. Utility Company charges associated with providing service.
      2. Coordinate the work with other trades to avoid placement of other utilities or obstructions within the spaces dedicated for electrical service and associated equipment.
      3. Coordinate arrangement of service entrance equipment with the dimensions and clearance requirements of the actual equipment to be installed.
4. Coordinate the work with other installers to provide communication lines required for Utility Company meters.
5. Notify Architect of any conflicts with or deviations from the contract documents. Obtain direction before proceeding with work.

C. Arrange for Utility Company to provide permanent electrical service. Prepare and submit documentation required by Utility Company.

D. Utility Company charges associated with providing permanent service to be paid by Owner.

E. Preinstallation Meeting: Convene one week prior to commencing work of this section to review service requirements and details with Utility Company representative.

F. Scheduling:
1. Where work of this section involves interruption of existing electrical service, arrange service interruption with Owner.
2. Arrange for inspections necessary to obtain Utility Company approval of installation.

1.05 SUBMITTALS

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

B. Utility Company letter of availability for providing electrical service to project.

C. Product Data: Provide manufacturer's standard catalog pages and data sheets for each product. Include ratings, configurations, standard wiring diagrams, outline and support point dimensions, finishes, weights, service condition requirements, and installed features.

D. Shop Drawings: Include dimensioned plan views and sections indicating locations and arrangement of Utility Company and service entrance equipment, metering provisions, required clearances, and proposed service routing.
   1. Obtain Utility company approval of shop drawings prior to submittal.

1.06 QUALITY ASSURANCE

A. Comply with the following:
   2. NFPA 70 (National Electrical Code).
   3. The requirements of the Utility Company.

1.07 DELIVERY, STORAGE, AND HANDLING

A. Receive, inspect, handle, and store products in accordance with manufacturer's instructions.

B. Store products indoors in a clean, dry space having a uniform temperature to prevent condensation (including outdoor rated products which are not weatherproof until completely and properly installed). Maintain factory wrapping or provide an additional heavy canvas or heavy plastic cover to protect units from dirt, water, construction debris, and traffic.

C. Handle products carefully to avoid damage to internal components, enclosure, and finish.

PART 2 PRODUCTS

2.01 ELECTRICAL SERVICE REQUIREMENTS

A. Provide new electrical service consisting of all required conduits, conductors, equipment, metering provisions, supports, accessories, etc. as necessary for connection between Utility Company point of supply and service entrance equipment.

B. Electrical Service Characteristics:
   1. Service Type: Underground.
   2. Service Voltage: 208Y/120 V, 3 phase, 60 Hz.

C. Division of Responsibility: As indicated on drawings.

D. Products Furnished by Contractor: Comply with Utility Company requirements.
PART 3 EXECUTION

3.01 INSTALLATION
A. Install products in accordance with manufacturer's instructions and Utility Company requirements.
B. Perform work in accordance with NECA 1 (general workmanship).
C. Arrange equipment to provide minimum clearances and required maintenance access.
D. Provide required support and attachment components in accordance with Section 26 0529.
E. Provide grounding and bonding for service entrance equipment in accordance with Section 26 0526.
F. Identify service entrance equipment, including main service disconnect(s) in accordance with Section 26 0553.

3.02 PROTECTION
A. Protect installed equipment from subsequent construction operations.

END OF SECTION
SECTION 26 2300
LOW-VOLTAGE SWITCHGEAR

PART 2 PRODUCTS

1.01 LOW-VOLTAGE SWITCHGEAR

A. Provide switchgear assemblies consisting of all required components, control power transformers, instrumentation and control wiring, accessories, etc. as necessary for a complete operating system.

B. Provide products listed, classified, and labeled as suitable for the purpose intended.

C. Description: Dead-front standard (non-arc-resistant) type metal-enclosed drawout switchgear complying with IEEE C37.20.1 and ANSI C37.51; listed and labeled as complying with UL 1558; ratings, configurations and features as indicated on the drawings.

D. Service Conditions:
   1. Provide switchgear and associated components suitable for operation under the following service conditions without derating:
      a. Altitude: Less than 6,600 feet (2,000 m).
      b. Ambient Temperature: Between -22 degrees F (-30 degrees C) and 104 degrees F (40 degrees C).
   2. Provide switchgear and associated components suitable for operation at indicated ratings under the service conditions at the installed location.

E. Short Circuit Current Rating:

F. Short-Time Current (30-Cycle Withstand) Rating: Equivalent to specified short circuit current rating.

G. Main Devices: Configure for top or bottom incoming feed as indicated or as required for the installation. Provide top-mounted pullbox as indicated or as required to facilitate installation of incoming feed.

H. Bussing: Sized in accordance with UL 1558 temperature rise requirements.
   1. Main bus (horizontal cross bus) to be fully rated through full length of switchgear.
   2. Provide solidly bonded equipment ground bus through full length of switchgear, with a suitable lug for each feeder and branch circuit equipment grounding conductor.
   3. Phase and Neutral Bus Material: Copper.

I. Conductor Terminations: Suitable for use with the conductors to be installed.
   1. Line Conductor Terminations:
      a. Main and Neutral Lug Material: Aluminum, suitable for terminating aluminum or copper conductors.
      b. Main and Neutral Lug Type: Mechanical.
   2. Load Conductor Terminations:
      a. Lug Material: Aluminum, suitable for terminating aluminum or copper conductors.
      b. Lug Type:

J. Enclosures:
   1. Environment Type per NEMA 250: Unless otherwise indicated, as specified for the following installation locations:
   2. Finish: Manufacturer's standard unless otherwise indicated.

K. Future Provisions:
   1. Prepare designated spaces for future installation of devices including bussing, connectors, mounting hardware and all other required provisions.

L. Instrument Transformers:
   2. Select suitable ratio, burden, and accuracy as required for connected devices.

1.02 LOW-VOLTAGE POWER CIRCUIT BREAKERS

A. Description: Quick-make, quick-break, trip-free low-voltage power circuit breakers with two-step stored energy closing mechanism; 100 percent rated; complying with IEEE C37.13, IEEE C37.16, IEEE C37.17, and ANSI C37.50; listed and labeled as complying with UL 1066; ratings, configurations, and features as indicated on the drawings.

B. Interrupting Capacity: Provide circuit breakers with interrupting capacity as required to provide the short circuit current rating indicated.

C. Construction: Drawout.
   1. Allows withdrawal of circuit breaker into test and disconnected positions, with racking position indication (connected, test, disconnected, withdrawn).
   2. Provide safety interlock to prevent racking of circuit breaker while in the ON position.

D. Trip Units: Solid state, microprocessor-based, true rms sensing.

END OF SECTION
SECTION 26 2413
SWITCHBOARDS

PART 1 GENERAL

1.01 SECTION INCLUDES
A. Low-voltage (600 V and less) switchboards and associated accessories for service and distribution applications.
B. Overcurrent protective devices for switchboards.

1.02 RELATED REQUIREMENTS
A. Section 03 3000 - Cast-in-Place Concrete: Concrete equipment pads.
B. Section 26 0526 - Grounding and Bonding for Electrical Systems.
C. Section 26 0529 - Hangers and Supports for Electrical Systems.
D. Section 26 0553 - Identification for Electrical Systems: Identification products and requirements.
E. Section 26 2513 - Low-Voltage Busways.
F. Section 26 2713 - Electricity Metering: For interface with equipment specified in this section.
G. Section 26 4300 - Surge Protective Devices.

1.03 REFERENCE STANDARDS
A. FS W-C-375 - Circuit Breakers, Molded Case; Branch Circuit and Service; 2013e (Amended 2017).
C. NECA 1 - Standard for Good Workmanship in Electrical Construction; 2015.
E. NEMA 250 - Enclosures for Electrical Equipment (1000 Volts Maximum); 2014.
F. NEMA PB 2 - Deadfront Distribution Switchboards; 2011.
G. NEMA PB 2.1 - General Instructions for Proper Handling, Installation, Operation, and Maintenance of Deadfront Distribution Switchboards Rated 600 Volts or Less; 2013.
I. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.
L. UL 891 - Switchboards; Current Edition, Including All Revisions.

1.04 ADMINISTRATIVE REQUIREMENTS
A. Coordination:
   1. Coordinate the work with other trades to avoid placement of ductwork, piping, equipment, or other potential obstructions within the dedicated equipment spaces and working clearances required by NFPA 70.
   2. Coordinate arrangement of electrical equipment with the dimensions and clearance requirements of the actual equipment to be installed.
   3. Verify with manufacturer that conductor terminations are suitable for use with the conductors to be installed.
   4. Coordinate with manufacturer to provide shipping splits suitable for the dimensional constraints of the installation.
5. Notify Architect of any conflicts with or deviations from the contract documents. Obtain direction before proceeding with work.

B. Service Entrance Switchboards:
   1. Coordinate with Utility Company to provide switchboards with suitable provisions for electrical service and utility metering, where applicable.
   2. Coordinate with Owner to arrange for Utility Company required access to equipment for installation and maintenance.
   3. Obtain Utility Company approval of switchboard prior to fabrication.
   4. Arrange for inspections necessary to obtain Utility Company approval of installation.

1.05 SUBMITTALS
   A. See Section 01 3000 - Administrative Requirements, for submittal procedures.
   B. Product Data: Provide manufacturer's standard catalog pages and data sheets for switchboards, enclosures, overcurrent protective devices, and other installed components and accessories.
      1. Include characteristic trip curves for each type and rating of overcurrent protective device upon request.
   C. Shop Drawings: Indicate dimensions, voltage, bus amperages, overcurrent protective device arrangement and sizes, short circuit current ratings, conduit entry locations, conductor terminal information, and installed features and accessories.
      1. Include dimensioned plan and elevation views of switchboards and adjacent equipment with all required clearances indicated.
      2. Include wiring diagrams showing all factory and field connections.
      3. Clearly indicate whether proposed short circuit current ratings are fully rated or, where acceptable, series rated systems.
   D. Field Quality Control Test Reports.

1.06 QUALITY ASSURANCE
   A. Conform to requirements of NFPA 70.
   B. Maintain at the project site a copy of each referenced document that prescribes execution requirements.
   C. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years documented experience.
   D. Product Listing Organization Qualifications: An organization recognized by OSHA as a Nationally Recognized Testing Laboratory (NRTL) and acceptable to authorities having jurisdiction.

1.07 DELIVERY, STORAGE, AND HANDLING
   A. Receive, inspect, handle, and store switchboards in accordance with manufacturer's instructions, NECA 400, and NEMA PB 2.1.
   B. Store in a clean, dry space having a uniform temperature to prevent condensation (including outdoor switchboards, which are not weatherproof until completely and properly installed). Where necessary, provide temporary enclosure space heaters or temporary power for permanent factory-installed space heaters.
   C. Maintain factory wrapping or provide an additional heavy canvas or heavy plastic cover to protect units from dirt, water, construction debris, and traffic.
   D. Handle carefully to avoid damage to switchboard internal components, enclosure, and finish.

PART 2 PRODUCTS
2.01 MANUFACTURERS
   A. Switchboards:
3. Schneider Electric; Square D Products: www.schneider-electric.us/#sle.

B. Substitutions: See Section 01 6000 - Product Requirements.

2.02 SWITCHBOARDS

A. Provide switchboards consisting of all required components, control power transformers, instrumentation and control wiring, accessories, etc. as necessary for a complete operating system.

B. Provide products listed, classified, and labeled as suitable for the purpose intended.

C. Description: Dead-front switchboard assemblies complying with NEMA PB 2, and listed and labeled as complying with UL 891; ratings, configurations and features as indicated on the drawings.

D. Service Entrance Switchboards:
   1. Listed and labeled as suitable for use as service equipment according to UL 869A.
   2. For solidly-grounded wye systems, provide factory-installed main bonding jumper between neutral and ground busses, and removable neutral disconnecting link for testing purposes.
   4. Utility Metering Provisions: Provide separate barriered compartment complying with Utility Company requirements where indicated or where required by Utility Company. Include hinged sealable door and provisions for Utility Company current transformers (CTs), potential transformers (PTs), or potential taps as required.

E. Switchboards With Busway Transitions: Configured for bussed connection to busway provided in accordance with Section 26 2513.

F. Service Conditions:
   1. Provide switchboards and associated components suitable for operation under the following service conditions without derating:
      a. Altitude: Less than 6,600 feet (2,000 m).
      b. Ambient Temperature:
         1) Switchboards Containing Molded Case or Insulated Case Circuit Breakers: Between 23 degrees F (-5 degrees C) and 104 degrees F (40 degrees C).
   2. Provide switchboards and associated components suitable for operation at indicated ratings under the service conditions at the installed location.

G. Short Circuit Current Rating:
   1. Provide switchboards with listed short circuit current rating not less than the available fault current at the installed location as determined by short circuit study performed in accordance with Section 26 0573.

H. Main Devices: Configure for top or bottom incoming feed as indicated or as required for the installation. Provide separate pull section and/or top-mounted pullbox as indicated or as required to facilitate installation of incoming feed.

I. Bussing: Sized in accordance with UL 891 temperature rise requirements.
   1. Through bus (horizontal cross bus) to be fully rated through full length of switchboard (non-tapered). Tapered bus is not permitted.
   2. Provide fully rated neutral bus unless otherwise indicated, with a suitable lug for each feeder or branch circuit requiring a neutral connection.
   3. Provide solidly bonded equipment ground bus through full length of switchboard, with a suitable lug for each feeder and branch circuit grounding conductor.
   5. Ground Bus Material: Aluminum.

J. Conductor Terminations: Suitable for use with the conductors to be installed.
   1. Line Conductor Terminations:
      a. Main and Neutral Lug Material: Aluminum, suitable for terminating aluminum or copper conductors.
b. Main and Neutral Lug Type: Mechanical.

2. Load Conductor Terminations:
   a. Lug Material: Aluminum, suitable for terminating aluminum or copper conductors.
   b. Lug Type:

K. Enclosures:
   1. Environment Type per NEMA 250: Unless otherwise indicated, as specified for the following installation locations:
      a. Indoor Clean, Dry Locations: Type 1 or Type 2 (drip-proof).
   2. Finish: Manufacturer's standard unless otherwise indicated.

L. Future Provisions:
   1. Prepare designated spaces for future installation of devices including bussing, connectors, mounting hardware and all other required provisions.

M. Arc Flash Energy-Reducing Maintenance Switching: For circuit breakers rated 1200 A or higher, provide a local accessory switch with status indicator light that permits selection of a maintenance mode with alternate electronic trip unit settings for reduced fault clearing time.

N. Owner Metering:
   1. Provide microprocessor-based digital electrical metering system including all instrument transformers, wiring, and connections necessary for measurements specified.
   2. Measured Parameters:
      a. Voltage (Volts AC): Line-to-line, line-to-neutral for each phase.
      b. Current (Amps): For each phase and neutral.
      c. Frequency (Hz).
      d. Real power (kW): For each phase, 3-phase total.
      e. Reactive power (kVAR): For each phase, 3-phase total.
      f. Apparent power (kVA): For each phase, 3-phase total.
      g. Power factor.
      h. Real energy (kWh).
   3. Meter Accuracy: Plus/minus 1.0 percent.

O. Instrument Transformers:
   2. Select suitable ratio, burden, and accuracy as required for connected devices.

2.03 OVERCURRENT PROTECTIVE DEVICES

A. Circuit Breakers:
   1. Interrupting Capacity:
      a. Provide circuit breakers with interrupting capacity as required to provide the short circuit current rating indicated, but not less than specified minimum requirements.
      b. Fully Rated Systems: Provide circuit breakers with interrupting capacity not less than the short circuit current rating indicated.
   2. Molded Case Circuit Breakers:
      a. Description: Quick-make, quick-break, over center toggle, trip-free, trip-indicating circuit breakers; listed and labeled as complying with UL 489, and complying with FS W-C-375 where applicable; ratings, configurations, and features as indicated on the drawings.
      b. Electronic Trip Circuit Breakers: Furnish solid state, microprocessor-based, true rms sensing trip units.
      c. Provide the following circuit breaker types where indicated:
         1) 100 Percent Rated Circuit Breakers: Listed for application within the switchboard where installed at 100 percent of the continuous current rating.
         2) Current Limiting Circuit Breakers: Without using fusible elements, designed to limit the let-through energy to a value less than the energy of a one-half cycle
wave of the symmetrical prospective current when operating within its current limiting range.

d. Provide the following features and accessories where indicated or where required to complete installation:
   1) Shunt Trip: Provide coil voltage as required for connection to indicated trip actuator.

3. Insulated Case Circuit Breakers:
   a. Description: Quick-make, quick-break, trip-free circuit breakers with two-step stored energy closing mechanism; standard 80 percent rated unless otherwise indicated; listed and labeled as complying with UL 489; ratings, configurations, and features as indicated on the drawings.
   b. Trip Units: Solid state, microprocessor-based, true rms sensing.

2.04 SOURCE QUALITY CONTROL
   A. See Section 01 4000 - Quality Requirements, for additional requirements.
   B. Factory test switchboards according to NEMA PB 2, including the following production (routine) tests on each switchboard assembly or component:
      1. Dielectric tests.
      2. Mechanical operation tests.
      3. Grounding of instrument transformer cases test.
      4. Electrical operation and control wiring tests, including polarity and sequence tests.
      5. Ground-fault sensing equipment test.

PART 3 EXECUTION

3.01 EXAMINATION
   A. Verify that field measurements are as indicated.
   B. Verify that the ratings and configurations of the switchboards and associated components are consistent with the indicated requirements.
   C. Verify that mounting surfaces are ready to receive switchboards.
   D. Verify that conditions are satisfactory for installation prior to starting work.

3.02 INSTALLATION
   A. Install products in accordance with manufacturer's instructions.
   B. Install switchboards in accordance with NECA 1 (general workmanship), NECA 400, and NEMA PB 2.1.
   C. Arrange equipment to provide required clearances and maintenance access, including accommodations for any drawout devices.
   D. Where switchboard is indicated to be mounted with inaccessible side against wall, provide minimum clearance of 1/2 inch (10 mm) between switchboard and wall.
   E. Provide required support and attachment components in accordance with Section 26 0529.
   F. Install switchboards plumb and level.
   G. Unless otherwise indicated, mount switchboards on properly sized 4 inch (100 mm) high concrete pad constructed in accordance with Section 03 3000.
   H. Provide grounding and bonding in accordance with Section 26 0526.
   I. Install all field-installed devices, components, and accessories.
   J. Where accessories are not self-powered, provide control power source as indicated or as required to complete installation.
   K. Set field-adjustable circuit breaker tripping function settings as determined by overcurrent protective device coordination study performed in accordance with Section 26 0573.
   L. Provide filler plates to cover unused spaces in switchboards.
3.03 FIELD QUALITY CONTROL
A. See Section 01 4000 - Quality Requirements, for additional requirements.
B. Provide services of a manufacturer's authorized representative to observe installation and assist in inspection and testing. Include manufacturer's reports with submittals.
C. Disconnect surge protective devices (SPDs) prior to performing any high potential testing. Replace SPDs damaged by performing high potential testing with SPDs connected.
D. Before energizing switchboard, perform insulation resistance testing in accordance with NECA 400 and NEMA PB 2.1.
E. Inspect and test in accordance with NETA ATS, except Section 4.
F. Perform inspections and tests listed in NETA ATS, Section 7.1.
G. Molded Case and Insulated Case Circuit Breakers: Perform inspections and tests listed in NETA ATS, Section 7.6.1.1 for all main circuit breakers and circuit breakers larger than ______ amperes. Tests listed as optional are not required.
H. Meters: Perform inspections and tests listed in NETA ATS, Section 7.11.2.
I. Instrument Transformers: Perform inspections and tests listed in NETA ATS, Section 7.10. The dielectric withstand tests on primary windings with secondary windings connected to ground listed as optional are not required.
J. Test shunt trips to verify proper operation.
K. Correct deficiencies and replace damaged or defective switchboards or associated components.
L. Submit detailed reports indicating inspection and testing results and corrective actions taken.

3.04 ADJUSTING
A. Adjust tightness of mechanical and electrical connections to manufacturer's recommended torque settings.
B. Adjust alignment of switchboard covers and doors.

3.05 CLEANING
A. Clean dirt and debris from switchboard enclosures and components according to manufacturer's instructions.
B. Repair scratched or marred surfaces to match original factory finish.

3.06 CLOSEOUT ACTIVITIES
A. See Section 01 7800 - Closeout Submittals, for closeout submittals.
B. See Section 01 7900 - Demonstration and Training, for additional requirements.
C. Training: Train Owner's personnel on operation, adjustment, and maintenance of switchboard and associated devices.
   1. Use operation and maintenance manual as training reference, supplemented with additional training materials as required.

3.07 PROTECTION
A. Protect installed switchboards from subsequent construction operations.

END OF SECTION
SECTION 26 2416
PANELBOARDS

PART 1 GENERAL

1.01 SECTION INCLUDES
A. Power distribution panelboards.
B. Lighting and appliance panelboards.
C. Overcurrent protective devices for panelboards.

1.02 RELATED REQUIREMENTS
A. Section 03 3000 - Cast-in-Place Concrete: Concrete equipment pads.
B. Section 26 0526 - Grounding and Bonding for Electrical Systems.
C. Section 26 0529 - Hangers and Supports for Electrical Systems.
D. Section 26 0553 - Identification for Electrical Systems: Identification products and requirements.
E. Section 26 0573 - Power System Studies: Additional criteria for the selection and adjustment of equipment and associated protective devices specified in this section.
F. Section 26 2200 - Low-Voltage Transformers: Small power centers with integral primary breaker, transformer, and panelboard.
G. Section 26 2713 - Electricity Metering: For interface with equipment specified in this section.

1.03 REFERENCE STANDARDS
A. FS W-C-375 - Circuit Breakers, Molded Case; Branch Circuit and Service; 2013e (Amended 2017).
B. NECA 1 - Standard for Good Workmanship in Electrical Construction; 2015.
D. NEMA 250 - Enclosures for Electrical Equipment (1000 Volts Maximum); 2014.
E. NEMA PB 1 - Panelboards; 2011.
F. NEMA PB 1.1 - General Instructions for Proper Installation, Operation and Maintenance of Panelboards Rated 600 Volts or Less; 2013.
H. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.
I. UL 50 - Enclosures for Electrical Equipment, Non-Environmental Considerations; Current Edition, Including All Revisions.
K. UL 67 - Panelboards; Current Edition, Including All Revisions.
N. UL 1053 - Ground-Fault Sensing and Relaying Equipment; Current Edition, Including All Revisions.

1.04 ADMINISTRATIVE REQUIREMENTS
A. Coordination:
1. Coordinate the work with other trades to avoid placement of ductwork, piping, equipment, or other potential obstructions within the dedicated equipment spaces and working clearances for electrical equipment required by NFPA 70.
2. Coordinate arrangement of electrical equipment with the dimensions and clearance requirements of the actual equipment to be installed.
3. Coordinate the work with other trades to provide walls suitable for installation of flush-mounted panelboards where indicated.
4. Verify with manufacturer that conductor terminations are suitable for use with the conductors to be installed.
5. Notify Architect of any conflicts with or deviations from the contract documents. Obtain direction before proceeding with work.

1.05 SUBMITTALS
A. See Section 01 3000 - Administrative Requirements, for submittal procedures.
B. Product Data: Provide manufacturer's standard catalog pages and data sheets for panelboards, enclosures, overcurrent protective devices, and other installed components and accessories.
   1. Include characteristic trip curves for each type and rating of overcurrent protective device upon request.
C. Shop Drawings: Indicate outline and support point dimensions, voltage, main bus ampacity, overcurrent protective device arrangement and sizes, short circuit current ratings, conduit entry locations, conductor terminal information, and installed features and accessories.
   1. Include dimensioned plan and elevation views of panelboards and adjacent equipment with all required clearances indicated.
   2. Include wiring diagrams showing all factory and field connections.
D. Manufacturer's Installation Instructions: Indicate application conditions and limitations of use stipulated by product testing agency. Include instructions for storage, handling, protection, examination, preparation, and installation of product.
E. Project Record Documents: Record actual installed locations of panelboards and actual installed circuiting arrangements.
F. Maintenance Data: Include information on replacement parts and recommended maintenance procedures and intervals.
G. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
   1. See Section 01 6000 - Product Requirements, for additional provisions.
   2. Panelboard Keys: Two of each different key.

1.06 QUALITY ASSURANCE
A. Conform to requirements of NFPA 70.
B. Maintain at the project site a copy of each referenced document that prescribes execution requirements.
C. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years documented experience.
D. Product Listing Organization Qualifications: An organization recognized by OSHA as a Nationally Recognized Testing Laboratory (NRTL) and acceptable to authorities having jurisdiction.

1.07 DELIVERY, STORAGE, AND HANDLING
A. Receive, inspect, handle, and store panelboards in accordance with manufacturer's instructions and NECA 407.
B. Store in a clean, dry space. Maintain factory wrapping or provide an additional heavy canvas or heavy plastic cover to protect units from dirt, water, construction debris, and traffic.
C. Handle carefully in accordance with manufacturer's written instructions to avoid damage to panelboard internal components, enclosure, and finish.
1.08 FIELD CONDITIONS
A. Maintain ambient temperature within the following limits during and after installation of panelboards:
   1. Panelboards Containing Circuit Breakers: Between 23 degrees F (-5 degrees C) and 104 degrees F (40 degrees C).

PART 2 PRODUCTS
2.01 MANUFACTURERS
A. Eaton Corporation; ______: www.eaton.com/#sle.
C. Schneider Electric; Square D Products; ______: www.schneider-electric.us/#sle.
D. Siemens Industry, Inc; ______: www.usa.siemens.com/#sle.
E. Substitutions: See Section 01 6000 - Product Requirements.
F. Source Limitations: Furnish panelboards and associated components produced by the same manufacturer as the other electrical distribution equipment used for this project and obtained from a single supplier.

2.02 PANELBOARDS - GENERAL REQUIREMENTS
A. Provide products listed, classified, and labeled as suitable for the purpose intended.
B. Unless otherwise indicated, provide products suitable for continuous operation under the following service conditions:
   1. Altitude: Less than 6,600 feet (2,000 m).
   2. Ambient Temperature:
      a. Panelboards Containing Circuit Breakers: Between 23 degrees F (-5 degrees C) and 104 degrees F (40 degrees C).
      b. Panelboards Containing Fusible Switches: Between -22 degrees F (-30 degrees C) and 104 degrees F (40 degrees C).
C. Short Circuit Current Rating:
   1. Provide panelboards with listed short circuit current rating not less than the available fault current at the installed location as determined by short circuit study performed in accordance with Section 26 0573.
   2. Label equipment utilizing series ratings as required by NFPA 70.
D. Panelboards Used for Service Entrance: Listed and labeled as suitable for use as service equipment according to UL 869A.
E. Mains: Configure for top or bottom incoming feed as indicated or as required for the installation.
F. Branch Overcurrent Protective Devices: Replaceable without disturbing adjacent devices.
G. Bussing: Sized in accordance with UL 67 temperature rise requirements.
   1. Provide solidly bonded equipment ground bus in each panelboard, with a suitable lug for each feeder and branch circuit equipment grounding conductor.
H. Conductor Terminations: Suitable for use with the conductors to be installed.
I. Enclosures: Comply with NEMA 250, and list and label as complying with UL 50 and UL 50E.
   1. Environment Type per NEMA 250: Unless otherwise indicated, as specified for the following installation locations:
      a. Indoor Clean, Dry Locations: Type 1.
   2. Boxes: Galvanized steel unless otherwise indicated.
      a. Provide wiring gutters sized to accommodate the conductors to be installed.
      b. Increase gutter space as required where sub-feed lugs, feed-through lugs, gutter taps, or oversized lugs are provided.
      c. Provide removable end walls for NEMA Type 1 enclosures.
      d. Provide painted steel boxes for surface-mounted panelboards where indicated, finish to match fronts.
3. Fronts:
   a. Fronts for Surface-Mounted Enclosures: Same dimensions as boxes.
   b. Fronts for Flush-Mounted Enclosures: Overlap boxes on all sides to conceal rough opening.
   c. Finish for Painted Steel Fronts: Manufacturer's standard grey unless otherwise indicated.
4. Lockable Doors: All locks keyed alike unless otherwise indicated.

J. Future Provisions: Prepare all unused spaces for future installation of devices including bussing, connectors, mounting hardware and all other required provisions.

K. Ground Fault Protection: Where ground-fault protection is indicated, provide system listed and labeled as complying with UL 1053.
   1. Where electronic circuit breakers equipped with integral ground fault protection are used, provide separate neutral current sensor where applicable.
   2. Where accessory ground fault sensing and relaying equipment is used, equip companion overcurrent protective devices with ground-fault shunt trips.
      a. Use zero sequence ground fault detection method unless otherwise indicated.
      b. Provide test panel and field-adjustable ground fault pick-up and delay settings.

2.03 POWER DISTRIBUTION PANELBOARDS
A. Description: Panelboards complying with NEMA PB 1, power and feeder distribution type, circuit breaker type, and listed and labeled as complying with UL 67; ratings, configurations and features as indicated on the drawings.

B. Conductor Terminations:
   1. Main and Neutral Lug Material: Aluminum, suitable for terminating aluminum or copper conductors.
   2. Main and Neutral Lug Type: Mechanical.

C. Bussing:
   1. Phase and Neutral Bus Material: Aluminum.

D. Circuit Breakers:
   1. Provide bolt-on type or plug-in type secured with locking mechanical restraints.

E. Enclosures:
   1. Provide surface-mounted enclosures unless otherwise indicated.

2.04 LIGHTING AND APPLIANCE PANELBOARDS
A. Description: Panelboards complying with NEMA PB 1, lighting and appliance branch circuit type, circuit breaker type, and listed and labeled as complying with UL 67; ratings, configurations and features as indicated on the drawings.

B. Conductor Terminations:
   1. Main and Neutral Lug Material: Aluminum, suitable for terminating aluminum or copper conductors.
   2. Main and Neutral Lug Type: Mechanical.

C. Bussing:

D. Circuit Breakers: Thermal magnetic bolt-on type unless otherwise indicated.

E. Enclosures:
   1. Provide surface-mounted or flush-mounted enclosures as indicated.
   2. Fronts: Provide lockable hinged door with concealed hinges for access to overcurrent protective device handles without exposing live parts.
3. Provide clear plastic circuit directory holder mounted on inside of door.

F. Provide column-width panelboards with accessory column-width cable trough and pullbox where indicated.

### 2.05 OVERCURRENT PROTECTIVE DEVICES

**A. Molded Case Circuit Breakers:**

1. **Description:** Quick-make, quick-break, over center toggle, trip-free, trip-indicating circuit breakers listed and labeled as complying with UL 489, and complying with FS W-C-375 where applicable; ratings, configurations, and features as indicated on the drawings.

2. **Interrupting Capacity:**
   a. Provide circuit breakers with interrupting capacity as required to provide the short circuit current rating indicated, but not less than:
   b. **Fully Rated Systems:** Provide circuit breakers with interrupting capacity not less than the short circuit current rating indicated.

3. **Conductor Terminations:**
   a. **Lug Material:** Aluminum, suitable for terminating aluminum or copper conductors.

4. **Thermal Magnetic Circuit Breakers:** For each pole, furnish thermal inverse time tripping element for overload protection and magnetic instantaneous tripping element for short circuit protection.

5. **Electronic Trip Circuit Breakers:** Furnish solid state, microprocessor-based, true rms sensing trip units.

6. **Multi-Pole Circuit Breakers:** Furnish with common trip for all poles.

7. **Provide the following features and accessories where indicated or where required to complete installation:**
   a. **Shunt Trip:** Provide coil voltage as required for connection to indicated trip actuator.

### PART 3 EXECUTION

#### 3.01 INSTALLATION

A. Perform work in accordance with NECA 1 (general workmanship).

B. Install products in accordance with manufacturer's instructions.

C. Install panelboards in accordance with NECA 407 and NEMA PB 1.1.

D. Arrange equipment to provide minimum clearances in accordance with manufacturer's instructions and NFPA 70.

E. Provide required supports in accordance with Section 26 0529.

F. Install panelboards plumb.

G. Install flush-mounted panelboards so that trims fit completely flush to wall with no gaps and rough opening completely covered.

H. Mount panelboards such that the highest position of any operating handle for circuit breakers or switches does not exceed 79 inches (2000 mm) above the floor or working platform.

I. Mount floor-mounted power distribution panelboards on properly sized 3 inch (80 mm) high concrete pad constructed in accordance with Section 03 3000.

J. Provide minimum of six spare 1 inch (27 mm) trade size conduits out of each flush-mounted panelboard stubbed into accessible space above ceiling and below floor.

K. Provide grounding and bonding in accordance with Section 26 0526.

L. Install all field-installed branch devices, components, and accessories.

M. Set field-adjustable ground fault protection pickup and time delay settings as indicated.

N. Provide filler plates to cover unused spaces in panelboards.

#### 3.02 FIELD QUALITY CONTROL

A. See Section 01 4000 - Quality Requirements, for additional requirements.

B. Inspect and test in accordance with NETA ATS, except Section 4.
C. Molded Case Circuit Breakers: Perform inspections and tests listed in NETA ATS, Section 7.6.1.1 for all main circuit breakers and circuit breakers larger than _____ amperes. Tests listed as optional are not required.

D. Ground Fault Protection Systems: Test in accordance with manufacturer's instructions as required by NFPA 70.

E. Test shunt trips to verify proper operation.

F. Correct deficiencies and replace damaged or defective panelboards or associated components.

3.03 ADJUSTING

A. Adjust tightness of mechanical and electrical connections to manufacturer's recommended torque settings.

B. Adjust alignment of panelboard fronts.

3.04 CLEANING

A. Clean dirt and debris from panelboard enclosures and components according to manufacturer's instructions.

B. Repair scratched or marred exterior surfaces to match original factory finish.

END OF SECTION
SECTION 26 2513
LOW-VOLTAGE BUSWAYS

PART 1  GENERAL

1.01  SECTION INCLUDES
A. Feeder busway.
B. Plug-in busway.
C. Plug-in units for plug-in busway.

1.02  RELATED REQUIREMENTS
A. Section 03 3000 - Cast-in-Place Concrete: Concrete curbs for busway floor penetrations.
B. Section 07 8400 - Firestopping.
C. Section 26 0526 - Grounding and Bonding for Electrical Systems.
D. Section 26 0529 - Hangers and Supports for Electrical Systems.
E. Section 26 0553 - Identification for Electrical Systems: Identification products and requirements.

1.03  REFERENCE STANDARDS
A. IEC 60529 - Degrees of Protection Provided by Enclosures (IP Code); 2013 (Corrigendum 2015).
B. NECA 1 - Standard for Good Workmanship in Electrical Construction; 2015.
C. NECA 408 - Standard for Installing and Maintaining Busways; 2015.
D. NEMA 250 - Enclosures for Electrical Equipment (1000 Volts Maximum); 2014.
E. NEMA BU 1.1 - General Instructions for Handling, Installation, Operation, and Maintenance of Busway Rated 600 Volts or Less; 2010.
F. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.
G. UL 857 - Busways; Current Edition, Including All Revisions.

1.04  ADMINISTRATIVE REQUIREMENTS
A. Coordination:
   1. Coordinate the arrangement of busway with structural members, ductwork, piping, equipment and other potential conflicts installed under other sections or by others. Coordinate the work with other trades to avoid installation of obstructions within busway required clearances.
   2. Coordinate arrangement of busway with the dimensions and clearance requirements of the actual equipment to be installed.
   3. Coordinate the work with placement of supports, anchors, etc. required for mounting.
   4. Verify with manufacturer that conductor terminations are suitable for use with the conductors to be installed.
   5. Where busway extends through roof, coordinate the work with other trades to provide roof penetrations that preserve the integrity of the roofing system and do not void the roof warranty.
   6. Notify Architect of any conflicts with or deviations from the contract documents. Obtain direction before proceeding with work.
B. Preinstallation Meeting: Convene one week prior to performing field measurements for busway fabrication drawings; require attendance of all affected installers. Review proposed routing, sequence of installation, and protection requirements for installed busway.
C. Sequencing:
   1. Perform field measurements prior to busway fabrication. Where necessary, perform field measurement for custom lengths after installation of adjacent sections.
1.05 SUBMITTALS
A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide manufacturer's standard catalog pages and data sheets for busway system components and accessories. Include dimensions, weight, materials, fabrication details, finishes, and service condition requirements. Indicate voltage and current ratings, short circuit current ratings, configurations, and installed features and accessories.
   1. Include busway resistance, reactance, and impedance data and voltage drop ratings.
   2. Include characteristic trip curves for each type and rating of circuit breaker plug-in device upon request.
   3. Clearly indicate whether proposed short circuit current ratings are fully rated or, where acceptable, series rated systems.
   4. Include documentation of listed series ratings upon request.

C. Shop Drawings: Include dimensioned plan views and sections indicating proposed busway routing, required clearances, and locations and details of supports, fittings, building element penetrations, and equipment connections.

D. Where roof penetrations are provided, certify that work does not void roof warranty.

E. Manufacturer's Installation Instructions: Indicate application conditions and limitations of use stipulated by product testing agency. Include instructions for storage, handling, protection, examination, preparation, and installation of product.

1.06 QUALITY ASSURANCE
A. Conform to requirements of NFPA 70.

B. Maintain at the project site a copy of each referenced document that prescribed execution requirements.

C. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years documented experience.

D. Product Listing Organization Qualifications: An organization recognized by OSHA as a Nationally Recognized Testing Laboratory (NRTL) and acceptable to authorities having jurisdiction.

1.07 DELIVERY, STORAGE, AND HANDLING
A. Receive, inspect, handle, and store busway in accordance with manufacturer's instructions, NECA 408, and NEMA BU 1.1.

B. Store products indoors in a clean, dry space having a uniform temperature to prevent condensation (including outdoor busway, which is not weatherproof until completely and properly installed). Maintain factory wrapping or provide an additional heavy canvas or heavy plastic cover to protect units from dirt, water, construction debris, and traffic.

C. Handle products carefully to avoid damage to internal components, enclosure, and finish.

1.08 FIELD CONDITIONS
A. Maintain field conditions within required service conditions during and after installation.

PART 2 PRODUCTS
2.01 MANUFACTURERS
A. Busway System:
   3. Schneider Electric; Square D Products: www.schneider-electric.us/#sle.

2.02 BUSWAY SYSTEM
A. Provide new busway system consisting of all required components, fittings, devices, supports, accessories, etc. as necessary for a complete operating system.
B. Provide products listed, classified, and labeled as suitable for the purpose intended.

C. Description: Prefabricated sectionalized enclosed bus assemblies and associated fittings and devices; listed and labeled as complying with UL 857.

D. Busway General Requirements:
   1. Busway Type: Totally enclosed, non-ventilated; suitable for installation in any mounting orientation the busway is designed for (e.g. horizontal flatwise, horizontal edgewise, vertical) without derating.
   2. Temperature Rise: Not exceeding 55 degrees C, when operating at continuous rated current in an ambient temperature of 104 degrees F (40 degrees C).
   3. Busbars and stabs to be suitably plated at all electrical contact points.
   4. Busbar Insulation: NEMA Class B, rated 266 degrees F (130 degrees C).
   5. Housing: Steel or aluminum, with manufacturer's standard finish unless otherwise indicated.
   6. Single-Bolt Type Joints:
      a. Use torque-indicating bolts with visual indication that proper torque has been applied.
      b. Bolts to be at ground potential to allow adjustment without requiring de-energizing of busway.
      c. Designed such that tightening of joints only requires access to one side of busway.
      d. Allows for length adjustment of plus/minus 0.125 inch (3.2 mm).

E. Service Conditions:
   1. Provide busway system and associated components suitable for operation under the following service conditions without derating:
      a. Altitude: Less than 6,600 feet (2,000 m).
      b. Ambient Temperature:
         1) Busway Lengths and Fittings: Between -22 degrees F (-30 degrees C) and 104 degrees F (40 degrees C).
   2. Provide busway system and associated components suitable for operation at indicated ratings under the service conditions at the installed location.

F. Short Circuit Current Rating:

2.03 FEEDER BUSWAY
   A. General Requirements:
      1. Outdoor Feeder Busway: Weatherproof, NEMA 250 Type 3R, with sealed joint covers and drain holes with removable plugs.
      2. Indoor Feeder Busway: Standard (not splash resistant), with IEC 60529 rating of IP 40.

2.04 PLUG-IN BUSWAY
   A. General Requirements:
      1. Provide cover at each unused plug-in opening.
      2. Provide means for mechanical support and alignment of plug-in units.
      3. IEC 60529 Protection Rating: Standard (not splash resistant), with rating of IP 40.

2.05 PLUG-IN UNITS FOR PLUG-IN BUSWAY
   A. Description: Plug-in units suitable for use with installed busway; types, ratings, configurations, and features as indicated on the drawings.
   B. General Requirements:
      1. Designed to make positive ground connection prior to phase/neutral connections when installed.
      2. Where splash resistant busway is specified, provide splash resistant plug-in units with minimum IEC 60529 rating of IP 54 unless otherwise indicated.

PART 3 EXECUTION

3.01 INSTALLATION
   A. Install products in accordance with manufacturer's instructions.
B. Install busway in accordance with NECA 1 (general workmanship), NECA 408, and NEMA BU 1.1.

C. Unless otherwise indicated, arrange busway to be parallel or perpendicular to building lines.

D. Arrange busway to provide required clearances and maintenance access.

E. Install busway plumb and level, with sections aligned and with horizontal runs at the proper elevation.

F. Unless otherwise indicated, orient horizontal plug-in busway with plug-in openings on sides (edgewise orientation).

G. Maintain proper phase sequence throughout busway system, accounting for phase transitions where applicable.

H. Provide suitable expansion fittings where busway is subject to movement, including but not limited to:
   1. Where busway crosses structural joints intended for expansion.
   2. Long straight busway runs in accordance with manufacturer's instructions.

I. Provide end closures at unconnected ends of busway runs.

J. Busway Support:
   1. Use manufacturer's recommended hangers and supports, located at intervals complying with NFPA 70 and manufacturer's requirements. Provide required support and attachment components in accordance with Section 26 0529, where not furnished by busway manufacturer.
   2. Provide independent support from building structure. Do not provide support from piping, ductwork, or other systems.
   3. Provide sway bracing as indicated or as required to keep busway runs straight and prevent rotation and movement, accounting for unbalanced weight distribution of plug-in units where applicable.

K. Penetrations:
   1. Provide suitable flanges where busway penetrates building elements. Use weatherproof flanges for exterior wall or roof penetrations. Seal roof penetrations as indicated or as required to preserve integrity of roofing system and maintain roof warranty.
   2. Install firestopping to preserve fire resistance rating of building elements, using materials and methods specified in Section 07 8400.
   3. Where busway penetrates floor, provide 4 inch (100 mm) high concrete curb constructed in accordance with Section 03 3000 around openings in accordance with NFPA 70.

L. Outdoor Feeder Busway: Arrange busway to prevent water infiltration through drain holes from rain or snow. Seal joints in accordance with manufacturer's instructions and remove drain hole plugs.

M. Plug-In Units:
   1. Install plug-in units on plug-in busway in accordance with manufacturer's instructions. Provide independent supports where recommended by manufacturer.
   2. Unless otherwise indicated, final connections from plug-in units to loads to be provided by Contractor.

N. Provide grounding and bonding in accordance with Section 26 0526.
   1. Where integral housing ground is utilized, verify joint covers and other components required for continuity are properly installed.

3.02 FIELD QUALITY CONTROL

A. See Section 01 4000 - Quality Requirements, for additional requirements.

B. Electrically isolate busway system before energizing and perform insulation resistance testing in accordance with NECA 408 and NEMA BU 1.1.

C. Correct deficiencies and replace damaged or defective busway system components.
3.03 ADJUSTING
   A. Adjust tightness of mechanical and electrical connections to manufacturer's recommended torque settings.
   B. Adjust supports as required to minimize strain on busway and associated components.

3.04 CLEANING
   A. Clean dirt and debris from busway enclosure and components in accordance with manufacturer's instructions. Do not use compressed air or a blower in order to prevent debris infiltration.
   B. Clean exposed surfaces to remove dirt, paint, or other foreign material and restore to match original factory finish.

3.05 CLOSEOUT ACTIVITIES

3.06 PROTECTION
   A. Protect busway system from subsequent construction operations.

END OF SECTION
SECTION 26 2816.13
ENCLOSED CIRCUIT BREAKERS

PART 1 GENERAL

1.01 SECTION INCLUDES
A. Enclosed circuit breakers.

1.02 RELATED REQUIREMENTS
A. Section 26 0526 - Grounding and Bonding for Electrical Systems.
B. Section 26 0529 - Hangers and Supports for Electrical Systems.
C. Section 26 0553 - Identification for Electrical Systems: Identification products and requirements.
D. Section 26 0573 - Power System Studies: Additional criteria for the selection and adjustment of equipment and associated protective devices specified in this section.

1.03 REFERENCE STANDARDS
A. FS W-C-375 - Circuit Breakers, Molded Case; Branch Circuit and Service; 2013e (Amended 2017).
B. NECA 1 - Standard for Good Workmanship in Electrical Construction; 2015.
C. NEMA 250 - Enclosures for Electrical Equipment (1000 Volts Maximum); 2014.
D. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.
E. UL 50 - Enclosures for Electrical Equipment, Non-Environmental Considerations; Current Edition, Including All Revisions.

1.04 ADMINISTRATIVE REQUIREMENTS
A. Coordination:
   1. Coordinate work with other trades. Avoid placement of ductwork, piping, equipment, or other potential obstructions within dedicated equipment spaces and within working clearances for electrical equipment required by NFPA 70.
   2. Coordinate arrangement of electrical equipment with the dimensions and clearance requirements of the actual equipment to be installed.
   3. Verify with manufacturer that conductor terminations are suitable for use with the conductors to be installed.
   4. Notify Architect of any conflicts with or deviations from the contract documents. Obtain direction before proceeding with work.

1.05 SUBMITTALS
A. See Section 01 3000 - Administrative Requirements, for submittal procedures.
B. Product Data: Provide manufacturer's standard catalog pages and data sheets for circuit breakers, enclosures, and other installed components and accessories.
   1. Include characteristic trip curves for each type and rating of circuit breaker upon request.
C. Shop Drawings: Indicate outline and support point dimensions, voltage and current ratings, short circuit current ratings, conduit entry locations, conductor terminal information, and installed features and accessories.
   1. Include dimensioned plan and elevation views of enclosed circuit breakers and adjacent equipment with all required clearances indicated.
1.06 QUALITY ASSURANCE
   A. Conform to requirements of NFPA 70.

1.07 DELIVERY, STORAGE, AND HANDLING
   A. Store in a clean, dry space. Maintain factory wrapping or provide an additional heavy canvas or heavy plastic cover to protect units from dirt, water, construction debris, and traffic.
   B. Handle carefully in accordance with manufacturer's written instructions to avoid damage to enclosed circuit breaker internal components, enclosure, and finish.

PART 2 PRODUCTS

2.01 MANUFACTURERS
   A. Eaton Corporation; _____: www.eaton.com/#sle.
   C. Schneider Electric; Square D Products; _____: www.schneider-electric.us/#sle.
   D. Siemens Industry, Inc; _____: www.usa.siemens.com/#sle.
   E. Source Limitations: Furnish enclosed circuit breakers and associated components produced by the same manufacturer as the other electrical distribution equipment used for this project and obtained from a single supplier.

2.02 ENCLOSED CIRCUIT BREAKERS
   A. Description: Units consisting of molded case circuit breakers individually mounted in enclosures.
   B. Provide products listed, classified, and labeled as suitable for the purpose intended.
   C. Unless otherwise indicated, provide products suitable for continuous operation under the following service conditions:
      1. Altitude: Less than 6,600 feet (2,000 m).
      2. Ambient Temperature: Between 23 degrees F (-5 degrees C) and 104 degrees F (40 degrees C).
   D. Short Circuit Current Rating:
      1. Provide enclosed circuit breakers with listed short circuit current rating not less than the available fault current at the installed location as determined by short circuit study performed in accordance with Section 26 0573.
   E. Enclosed Circuit Breakers Used for Service Entrance: Listed and labeled as suitable for use as service equipment according to UL 869A.
   F. Conductor Terminations: Suitable for use with the conductors to be installed.
   G. Provide solidly bonded equipment ground bus in each enclosed circuit breaker, with a suitable lug for terminating each equipment grounding conductor.
   H. Enclosures: Comply with NEMA 250, and list and label as complying with UL 50 and UL 50E.
      1. Environment Type per NEMA 250: Unless otherwise indicated, as specified for the following installation locations:
         a. Indoor Clean, Dry Locations: Type 1.
         b. Outdoor Locations: Type 3R.
   I. Provide externally operable handle with means for locking in the OFF position.

2.03 MOLDED CASE CIRCUIT BREAKERS
   A. Description: Quick-make, quick-break, over center toggle, trip-free, trip-indicating circuit breakers listed and labeled as complying with UL 489, and complying with FS W-C-375 where applicable; ratings, configurations, and features as indicated on the drawings.
   B. Interrupting Capacity:
      1. Provide circuit breakers with interrupting capacity as required to provide the short circuit current rating indicated, but not less than:
2. Fully Rated Systems: Provide circuit breakers with interrupting capacity not less than the short circuit current rating indicated.

C. Conductor Terminations:
   1. Lug Material: Aluminum, suitable for terminating aluminum or copper conductors.

D. Multi-Pole Circuit Breakers: Furnish with common trip for all poles.

PART 3 EXECUTION

3.01 EXAMINATION
   A. Verify that field measurements are as indicated.
   B. Verify that the ratings of the enclosed circuit breakers are consistent with the indicated requirements.
   C. Verify that mounting surfaces are ready to receive enclosed circuit breakers.
   D. Verify that conditions are satisfactory for installation prior to starting work.

3.02 INSTALLATION
   A. Install products in accordance with manufacturer's instructions.
   B. Perform work in accordance with NECA 1 (general workmanship).
   C. Arrange equipment to provide minimum clearances in accordance with manufacturer's instructions and NFPA 70.
   D. Provide required supports in accordance with Section 26 0529.
   E. Install enclosed circuit breakers plumb.
   F. Except where indicated to be mounted adjacent to the equipment they supply, mount enclosed circuit breakers such that the highest position of the operating handle does not exceed 79 inches (2000 mm) above the floor or working platform.
   G. Provide grounding and bonding in accordance with Section 26 0526.

3.03 CLEANING
   A. Clean dirt and debris from circuit breaker enclosures and components according to manufacturer's instructions.
   B. Repair scratched or marred exterior surfaces to match original factory finish.

END OF SECTION
SECTION 26 2816.16
ENCLOSED SWITCHES

PART 1 GENERAL

1.01 SECTION INCLUDES
A. Enclosed safety switches.

1.02 RELATED REQUIREMENTS
A. Section 26 0526 - Grounding and Bonding for Electrical Systems.
B. Section 26 0529 - Hangers and Supports for Electrical Systems.
C. Section 26 0553 - Identification for Electrical Systems: Identification products and requirements.
D. Section 26 0573 - Power System Studies: Additional criteria for the selection of equipment and associated protective devices specified in this section.
E. Section 26 2513 - Low-Voltage Busways: Fusible switch busway plug-in units.
F. Section 26 3600 - Transfer Switches: Automatic and non-automatic switches listed for use as transfer switch equipment.

1.03 REFERENCE STANDARDS
A. NECA 1 - Standard for Good Workmanship in Electrical Construction; 2015.
B. NEMA 250 - Enclosures for Electrical Equipment (1000 Volts Maximum); 2014.
C. NEMA KS 1 - Heavy Duty Enclosed and Dead-Front Switches (600 Volts Maximum); 2013.
E. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.
F. UL 50 - Enclosures for Electrical Equipment, Non-Environmental Considerations; Current Edition, Including All Revisions.
H. UL 98 - Enclosed and Dead-Front Switches; Current Edition, Including All Revisions.

1.04 ADMINISTRATIVE REQUIREMENTS
A. Coordination:
   1. Coordinate the work with other trades. Avoid placement of ductwork, piping, equipment, or other potential obstructions within the dedicated equipment spaces and within working clearances for electrical equipment required by NFPA 70.
   2. Coordinate arrangement of electrical equipment with the dimensions and clearance requirements of the actual equipment to be installed.
   3. Verify with manufacturer that conductor terminations are suitable for use with the conductors to be installed.
   4. Notify Architect of any conflicts with or deviations from the contract documents. Obtain direction before proceeding with work.

1.05 SUBMITTALS
A. See Section 01 3000 - Administrative Requirements, for submittal procedures.
B. Product Data: Provide manufacturer's standard catalog pages and data sheets for enclosed switches and other installed components and accessories.
C. Shop Drawings: Indicate outline and support point dimensions, voltage and current ratings, short circuit current ratings, conduit entry locations, conductor terminal information, and installed features and accessories.
1. Include dimensioned plan and elevation views of enclosed switches and adjacent equipment with all required clearances indicated.
2. Include wiring diagrams showing all factory and field connections.
D. Field Quality Control Test Reports.
E. Manufacturer's Installation Instructions: Indicate application conditions and limitations of use stipulated by product testing agency. Include instructions for storage, handling, protection, examination, preparation, installation, and starting of product.

1.06 QUALITY ASSURANCE
A. Conform to requirements of NFPA 70.

1.07 DELIVERY, STORAGE, AND HANDLING
A. Store in a clean, dry space. Maintain factory wrapping or provide an additional heavy canvas or heavy plastic cover to protect units from dirt, water, construction debris, and traffic.
B. Handle carefully in accordance with manufacturer's written instructions to avoid damage to enclosed switch internal components, enclosure, and finish.

1.08 FIELD CONDITIONS
A. Maintain ambient temperature between -22 degrees F (-30 degrees C) and 104 degrees F (40 degrees C) during and after installation of enclosed switches.

PART 2 PRODUCTS
2.01 MANUFACTURERS
A. Eaton Corporation; ______: www.eaton.com/#sle.
C. Schneider Electric; Square D Products; ______: www.schneider-electric.us/#sle.
D. Siemens Industry, Inc; ______: www.usa.siemens.com/#sle.
E. Source Limitations: Furnish enclosed switches and associated components produced by the same manufacturer as the other electrical distribution equipment used for this project and obtained from a single supplier.

2.02 ENCLOSED SAFETY SWITCHES
A. Description: Quick-make, quick-break enclosed safety switches listed and labeled as complying with UL 98; heavy duty; ratings, configurations, and features as indicated on the drawings.
B. Provide products listed, classified, and labeled as suitable for the purpose intended.
C. Unless otherwise indicated, provide products suitable for continuous operation under the following service conditions:
   1. Altitude: Less than 6,600 feet (2,000 m).
   2. Ambient Temperature: Between -22 degrees F (-30 degrees C) and 104 degrees F (40 degrees C).
D. Horsepower Rating: Suitable for connected load.
E. Voltage Rating: Suitable for circuit voltage.
F. Short Circuit Current Rating:
   1. Provide enclosed safety switches, when protected by the fuses or supply side overcurrent protective devices to be installed, with listed short circuit current rating not less than the available fault current at the installed location as determined by short circuit study performed in accordance with Section 26 0573.
G. Provide with switch blade contact position that is visible when the cover is open.
H. Conductor Terminations: Suitable for use with the conductors to be installed.
I. Provide solidly bonded equipment ground bus in each enclosed safety switch, with a suitable lug for terminating each equipment grounding conductor.
J. Enclosures: Comply with NEMA 250, and list and label as complying with UL 50 and UL 50E.
   1. Environment Type per NEMA 250: Unless otherwise indicated, as specified for the following installation locations:

K. Provide safety interlock to prevent opening the cover with the switch in the ON position with capability of overriding interlock for testing purposes.

L. Heavy Duty Switches:
   2. Conductor Terminations:
      a. Lug Material: Aluminum, suitable for terminating aluminum or copper conductors.
   3. Provide externally operable handle with means for locking in the OFF position, capable of accepting three padlocks.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that field measurements are as indicated.
B. Verify that the ratings of the enclosed switches are consistent with the indicated requirements.
C. Verify that mounting surfaces are ready to receive enclosed safety switches.
D. Verify that conditions are satisfactory for installation prior to starting work.

3.02 INSTALLATION

A. Install products in accordance with manufacturer's instructions.
B. Perform work in accordance with NECA 1 (general workmanship).
C. Arrange equipment to provide minimum clearances in accordance with manufacturer's instructions and NFPA 70.
D. Provide required supports in accordance with Section 26 0529.
E. Install enclosed switches plumb.
F. Except where indicated to be mounted adjacent to the equipment they supply, mount enclosed switches such that the highest position of the operating handle does not exceed 79 inches (2000 mm) above the floor or working platform.
G. Provide grounding and bonding in accordance with Section 26 0526.

3.03 FIELD QUALITY CONTROL

A. See Section 01 4000 - Quality Requirements, for additional requirements.
B. Inspect and test in accordance with NETA ATS, except Section 4.
C. Perform inspections and tests listed in NETA ATS, Section 7.5.1.1.
D. Correct deficiencies and replace damaged or defective enclosed safety switches or associated components.

3.04 ADJUSTING

A. Adjust tightness of mechanical and electrical connections to manufacturer's recommended torque settings.

3.05 CLEANING

A. Clean dirt and debris from switch enclosures and components according to manufacturer's instructions.
B. Repair scratched or marred exterior surfaces to match original factory finish.

END OF SECTION
PART 2 PRODUCTS

1.01 ENCLOSED CONTROLLERS

A. Provide enclosed controller assemblies consisting of all required components, control power transformers, instrumentation and control wiring, accessories, etc. as necessary for a complete operating system.

B. Provide products listed, classified, and labeled as suitable for the purpose intended.

C. Description: Enclosed controllers complying with NEMA ICS 2, and listed and labeled as complying with UL 60947-1 and UL 60947-4-1; ratings, configurations and features as indicated on the drawings.

D. Service Conditions:
   1. Provide controllers and associated components suitable for operation under the following service conditions without derating:
      a. Altitude:
         1) Class 1 Km Equipment (devices utilizing power semiconductors, e.g. variable frequency controllers): Less than 3,300 feet (1,000 m).
         2) Class 2 Km Equipment (electromagnetic and manual devices): Less than 6,600 feet (2,000 m).
      b. Ambient Temperature: Between 32 degrees F (0 degrees C) and 104 degrees F (40 degrees C).
   2. Provide controllers and associated components suitable for operation at indicated ratings under the service conditions at the installed location.

E. Short Circuit Current Rating:

F. Conductor Terminations: Suitable for use with the conductors to be installed.

G. Enclosures:
   2. Environment Type per NEMA 250: Unless otherwise indicated, as specified for the following installation locations:
   3. Finish: Manufacturer's standard unless otherwise indicated.

H. Instrument Transformers:
   2. Select suitable ratio, burden, and accuracy as required for connected devices.

1.02 OVERCURRENT PROTECTIVE DEVICES

A. Overload Relays:
   1. Provide overload relays and, where applicable, associated current elements/heaters, selected according to actual installed motor nameplate data, in accordance with manufacturer's recommendations and NFPA 70; include consideration for motor service factor and ambient temperature correction, where applicable.
   2. Inverse-Time Trip Class Rating: Class 20 unless otherwise indicated or required.
   3. Trip-free operation.
   4. Visible trip indication.
   5. Resettable.
      a. Employ manual reset unless otherwise indicated.
      b. Do not employ automatic reset with two-wire control.

END OF SECTION
SECTION 26 4113
LIGHTNING PROTECTION FOR STRUCTURES

PART 1 GENERAL

1.01 SECTION INCLUDES
   A. Strike (air) terminals and interconnecting conductors.
   B. Grounding and bonding for lightning protection.

1.02 RELATED REQUIREMENTS
   A. Surge Protection for Wiring Systems: Specified in individual system requirements.

1.03 REFERENCE STANDARDS
   B. UL 96 - Lightning Protection Components; Current Edition, Including All Revisions.

1.04 ADMINISTRATIVE REQUIREMENTS
   A. Coordination with Concrete Work: Coordinate the embedding of lightning protection components in concrete.
   B. Coordination with Roofing Work: Ensure adequate attachment of strike terminals and conductors without damage to roofing.
   C. Preinstallation Meeting: Convene a meeting at least two weeks prior to commencement of any work affected by lightning protection system requirements to discuss prerequisites and coordination required by other installers; require attendance by representatives of installers whose work will be affected.

1.05 SUBMITTALS
   A. See Section 01 3000 - Administrative Requirements, for submittal procedures.
   B. Shop Drawings: Indicate location and layout of air terminals, grounding electrodes, and bonding connections to structure and other metal objects. Include terminal, electrode, and conductor sizes, and connection and termination details.
      1. Where conductors or grounds are to be embedded or concealed in other construction, submit shop drawings at least 30 days prior to start of construction.
      2. If concrete-encased grounds are to be used and are not shown in the contract documents, provide sufficient data to determine concrete encasement dimensions and location.
      3. Include data on actual ground resistance determined by field measurement in accordance with NFPA 780.
      4. Include engineering analysis of equalization of potential to metal bodies within the structure.
      5. Include access panels, test holes, and disconnecting means for maintenance.
   C. Product Data: Provide dimensions and materials of each component, indication of testing agency listing, and installation instructions.
   D. Manufacturer's Certificate: Certify that products meet or exceed specified requirements.
   E. Installation Certification: Submit copy of certification agency's approval.
   F. Operation and Maintenance Data: Provide recommended inspection and testing plan, including recommended intervals, to achieve periodic maintenance as recommended in NFPA 780; provide customized plan reflecting actual installation configuration with specific installed components identified.
   G. Project Record Documents: Record actual locations of air terminals, grounding electrodes, bonding connections, and routing of system conductors in project record documents.

1.06 QUALITY ASSURANCE
   A. Maintain one copy of each referenced system design standard on site.
B. Manufacturer Qualifications: Company specializing in lightning protection equipment with minimum three years documented experience.

C. Designer Qualifications: Person or entity, employed by installer, who specializes in lightning protection system design with minimum three years documented experience.

D. Installer Qualifications: Capable of providing the specified certification of the installed system.

E. Products: Listed, classified, and labeled as suitable for the purpose intended.

F. Product Listing Organization Qualifications: An organization recognized by OSHA as a Nationally Recognized Testing Laboratory (NRTL) and acceptable to authorities having jurisdiction.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Lightning Protection Components:
   1. Advanced Lightning Technology (ALT); ______: www.altfab.com/#sle.
   5. thermOweld, subsidiary of Continental Industries; division of Burndy LLC; ________: www.thermoweld.com/#sle.
   6. Substitutions: See Section 01 6000 - Product Requirements.

2.02 LIGHTNING PROTECTION SYSTEM

A. Lightning Protection System: Provide complete system complying with NFPA 780, including air terminals, bonding, interconnecting conductors and grounding electrodes.
   1. Provide system that protects:
      a. The entire structure.
      b. Open air areas within 100 feet (30 meters) of exterior walls at grade level.
      c. Open air areas within building footprint.
   2. Coordinate with other grounding and bonding systems specified.
   3. Determine ground resistance by field measurement.
   4. Provide copper, bronze, or stainless steel components, as applicable; no aluminum.
   5. Provide system certified by Underwriters Laboratories or the Lightning Protection Institute.

2.03 COMPONENTS

A. All Components: Complying with applicable requirements of UL 96.
B. Strike (Air) Terminals: Copper, solid, with adhesive bases for single-ply roof installations.
C. Grounding Rods: Solid copper.
D. Ground Plate: Copper.
E. Conductors: Copper cable.
F. Connectors and Splicers: Bronze.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that field measurements are as indicated on shop drawings.
B. Coordinate work with installation of roofing and exterior and interior finishes.

3.02 INSTALLATION

A. Install in accordance with referenced system standards and as required for specified certification.
B. Connect conductors using mechanical connectors or exothermic welding process; protect adjacent construction elements and finishes from damage.
3.03 FIELD QUALITY CONTROL

A. See Section 01 4000 - Quality Requirements, for additional requirements.

B. Perform visual inspection as specified in NFPA 780 as if this were a periodic follow-up inspection.

C. Perform continuity testing as specified in NFPA 780 as if this were testing for periodic maintenance.

D. Obtain the services of the specified certification agency to provide inspection and certification of the lightning protection system, including performance of any other testing required by that agency.

END OF SECTION
SECTION 26 4300
SURGE PROTECTIVE DEVICES

PART 1 GENERAL

1.01 SECTION INCLUDES
A. Surge protective devices for service entrance locations.

1.02 RELATED REQUIREMENTS
A. Section 26 0526 - Grounding and Bonding for Electrical Systems.
B. Section 26 2300 - Low-Voltage Switchgear.
C. Section 26 2413 - Switchboards.
D. Section 26 2416 - Panelboards.
E. Section 26 2513 - Low-Voltage Busways.

1.03 REFERENCE STANDARDS
A. NECA 1 - Standard for Good Workmanship in Electrical Construction; 2015.
B. NEMA 250 - Enclosures for Electrical Equipment (1000 Volts Maximum); 2014.
D. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

1.04 ADMINISTRATIVE REQUIREMENTS
A. Coordination: Coordinate size and location of overcurrent device compatible with the actual surge protective device and location to be installed. Notify Architect of any conflicts or deviations from the contract documents to obtain direction prior to ordering equipment.

1.05 SUBMITTALS
A. See Section 01 3000 - Administrative Requirements, for submittal procedures.
B. Product Data: Include detailed component information, voltage, surge current ratings, repetitive surge current capacity, voltage protection rating (VPR) for all protection modes, maximum continuous operating voltage (MCOV), nominal discharge current (I-n), short circuit current rating (SCCR), connection means including any required external overcurrent protection, enclosure ratings, outline and support point dimensions, weight, service condition requirements, and installed features.
   1. SPDs with EMI/RFI filter: Include noise attenuation performance.
C. Shop Drawings: Include wiring diagrams showing all factory and field connections with wire and circuit breaker/fuse sizes.
D. Certificates: Manufacturer’s documentation of listing for compliance with the following standards:
   1. UL 1449.
E. Manufacturer’s Installation Instructions: Include application conditions and limitations of use stipulated by product testing agency. Include instructions for storage, handling, protection, examination, preparation, and installation of product.
F. Operation and Maintenance Data: Include information on status indicators and recommended maintenance procedures and intervals.
G. Warranty: Submit sample of manufacturer's warranty and documentation of final executed warranty completed in Owner's name and registered with manufacturer.
H. Project Record Documents: Record actual connections and locations of surge protective devices.

Bidding Documents - October 31st 2018
26 4300 - 1 SURGE PROTECTIVE DEVICES
1.06 QUALITY ASSURANCE
A. Conform to requirements of NFPA 70.
B. Maintain at the project site a copy of each referenced document that prescribes execution requirements.
C. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years documented experience.
D. Product Listing Organization Qualifications: An organization recognized by OSHA as a Nationally Recognized Testing Laboratory (NRTL) and acceptable to authorities having jurisdiction.

1.07 DELIVERY, STORAGE, AND PROTECTION
A. Store in a clean, dry space in accordance with manufacturer's written instructions.

1.08 FIELD CONDITIONS
A. Maintain field conditions within manufacturer's required service conditions during and after installation.

1.09 WARRANTY
A. See Section 01 7800 - Closeout Submittals, for additional warranty requirements.
B. Manufacturer's Warranty: Provide minimum five year warranty covering repair or replacement of surge protective devices showing evidence of failure due to defective materials or workmanship.
C. Exclude surge protective devices from any clause limiting warranty responsibility for acts of nature, including lightning, stated elsewhere.

PART 2 PRODUCTS
2.01 MANUFACTURERS
A. Field-installed, Externally Mounted Surge Protective Devices:
   1. Advanced Protection Technologies, Inc (APT); __________: www.apt surge.com/#sle.
   4. Schneider Electric; Square D Brand Surgelogic Products; _______: www.surgelogic.com/#sle.

B. Factory-installed, Internally Mounted Surge Protective Devices:
   1. Same as manufacturer of equipment containing surge protective device, to provide a complete listed assembly including SPD.
C. Substitutions: See Section 01 6000 - Product Requirements.
D. Source Limitations: Furnish surge protective devices produced by a single manufacturer and obtained from a single supplier.

2.02 SURGE PROTECTIVE DEVICES - GENERAL REQUIREMENTS
A. Description: Factory-assembled surge protective devices (SPDs) for 60 Hz service; listed, classified, and labeled as suitable for the purpose intended; system voltage as indicated on the drawings.
B. Protected Modes:
   2. Delta Systems: L-G, L-L.
C. UL 1449 Voltage Protection Ratings (VPRs):
   1. Equivalent to basis of design.
D. UL 1449 Maximum Continuous Operating Voltage (MCOV): Not less than 115% of nominal system voltage.

E. Enclosure Environment Type per NEMA 250: Unless otherwise indicated, as specified for the following installation locations:
   1. Indoor clean, dry locations: Type 1.

F. Mounting for Field-installed, Externally Mounted SPDs: Unless otherwise indicated, as specified for the following locations:
   1. Provide flush-mounted SPD where mounted in public areas or adjacent to flush-mounted equipment.

G. Equipment Containing Factory-installed, Internally Mounted SPDs: Listed and labeled as a complete assembly including SPD.
   1. Switchgear: See Section 26 2300.
   2. Switchboards: See Section 26 2413.

2.03 SURGE PROTECTIVE DEVICES FOR SERVICE ENTRANCE LOCATIONS

A. Unless otherwise indicated, provide field-installed, externally mounted or factory-installed, internally mounted SPDs.

B. List and label as complying with UL 1449, Type 1 when connected on line side of service disconnect overcurrent device and Type 1 or 2 when connected on load side of service disconnect overcurrent device.

C. Provide SPDs utilizing field-replaceable modular or non-modular protection circuits.

D. Surge Current Rating: Not less than 120 kA per mode/240 kA per phase.

E. UL 1449 Nominal Discharge Current (I-n): 20 kA.

F. UL 1449 Short Circuit Current Rating (SCCR): Not less than the available fault current at the installed location as indicated on the drawings.

G. Diagnostics:
   1. Protection Status Monitoring: Provide indicator lights to report the protection for each phase.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that field measurements are as indicated.

B. Verify that the service voltage and configuration marked on the SPD are consistent with the service voltage and configuration at the location to be installed.

C. Verify that electrical equipment is ready to accept connection of the SPD and that installed overcurrent device is consistent with requirements of drawings and manufacturer's instructions.

D. Verify system grounding and bonding is in accordance with Section 26 0526, including bonding of neutral and ground for service entrance and separately derived systems where applicable. Do not energize SPD until deficiencies have been corrected.

E. Verify that conditions are satisfactory for installation prior to starting work.

3.02 INSTALLATION

A. Perform work in accordance with NECA 1 (general workmanship).

B. Install products in accordance with manufacturer's instructions.

C. Arrange equipment to provide minimum clearances in accordance with manufacturer's instructions and NFPA 70.
D. Unless indicated otherwise, connect service entrance surge protective device on load side of service disconnect main overcurrent device.

E. Provide conductors with minimum ampacity as indicated on the drawings, as required by NFPA 70, and not less than manufacturer's recommended minimum conductor size.

F. Install conductors between SPD and equipment terminations as short and straight as possible, not exceeding manufacturer's recommended maximum conductor length. Breaker locations may be reasonably rearranged in order to provide leads as short and straight as possible. Twist conductors together to reduce inductance.

G. Do not energize SPD until bonding of neutral and ground for service entrance and separately derived systems is complete in accordance with Section 26 0526 where applicable. Replace SPDs damaged by improper or missing neutral-ground bond.

H. Disconnect SPD prior to performing any high potential testing. Replace SPDs damaged by performing high potential testing with SPD connected.

3.03 FIELD QUALITY CONTROL

A. See Section 01 4000 - Quality Requirements, for additional requirements.

B. Inspect and test in accordance with NETA ATS, except Section 4.

C. Perform inspections and tests listed in NETA ATS Section 7.19.1.

D. Procure services of a qualified manufacturer's representative to observe installation and assist in inspection, testing, and adjusting. Include manufacturer's reports with field quality control submittals.

3.04 CLEANING

A. Repair scratched or marred exterior surfaces to match original factory finish.

END OF SECTION
SECTION 26 5100
INTERIOR LIGHTING

PART 1  GENERAL

1.01  SECTION INCLUDES

A. Interior luminaires.
B. Emergency lighting units.
C. Exit signs.
D. Ballasts and drivers.
E. Fluorescent emergency power supply units.
F. Lamps.
G. Luminaire accessories.

1.02  RELATED REQUIREMENTS

A. Section 23 3600 - Air Terminal Units: Air distribution accessories for air handling luminaires.
B. Section 26 0533.16 - Boxes for Electrical Systems.
C. Section 26 0553 - Identification for Electrical Systems: Identification products and requirements.
D. Section 26 0918 - Remote Control Switching Devices: Remote controls for lighting, including network lighting controls, programmable relay panels, and remote control switching relays.
E. Section 26 0923 - Lighting Control Devices: Automatic controls for lighting including occupancy sensors, outdoor motion sensors, time switches, outdoor photo controls, and daylighting controls.
F. Section 26 2726 - Wiring Devices: Manual wall switches and wall dimmers.
G. Section 26 5013 - Luminaire Schedule.
H. Section 26 5113 - Luminaires, Ballasts, and Drivers - Lutron: Additional lighting products.
I. Section 26 5600 - Exterior Lighting.

1.03  REFERENCE STANDARDS

C. IEC 60529 - Degrees of Protection Provided by Enclosures (IP Code); 2013 (Corrigendum 2015).
G. NECA 1 - Standard for Good Workmanship in Electrical Construction; 2015.
J. NEMA 410 - Performance Testing for Lighting Controls and Switching Devices with Electronic Drivers and Discharge Ballasts; 2016.
K. NEMA LE 4 - Recessed Luminaires, Ceiling Compatibility; 2012.
L. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.


O. UL 935 - Fluorescent-Lamp Ballasts; Current Edition, Including All Revisions.

P. UL 1598 - Luminaires; Current Edition, Including All Revisions.


1.04 ADMINISTRATIVE REQUIREMENTS

A. Coordination:
   1. Coordinate the installation of luminaires with mounting surfaces installed under other sections or by others. Coordinate the work with placement of supports, anchors, etc. required for mounting. Coordinate compatibility of luminaires and associated trims with mounting surfaces at installed locations.
   2. Coordinate the placement of luminaires with structural members, ductwork, piping, equipment, diffusers, fire suppression system components, and other potential conflicts installed under other sections or by others.
   3. Coordinate the placement of exit signs with furniture, equipment, signage or other potential obstructions to visibility installed under other sections or by others.
   4. Notify Architect of any conflicts or deviations from the contract documents to obtain direction prior to proceeding with work.

1.05 SUBMITTALS

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

B. Shop Drawings:
   1. Indicate dimensions and components for each luminaire that is not a standard product of the manufacturer.
   2. Provide photometric calculations where luminaires are proposed for substitution upon request.

C. Product Data: Provide manufacturer's standard catalog pages and data sheets including detailed information on luminaire construction, dimensions, ratings, finishes, mounting requirements, listings, service conditions, photometric performance, installed accessories, and ceiling compatibility; include model number nomenclature clearly marked with all proposed features.
   1. LED Luminaires:
      a. Include estimated useful life, calculated based on IES LM-80 test data.
      b. Include IES LM-79 test report upon request.
   2. Ballasts: Include wiring diagrams and list of compatible lamp configurations.
   3. Lamps: Include rated life, color temperature, color rendering index (CRI), and initial and mean lumen output.
   4. Fluorescent Emergency Power Supply Unit: Include list of compatible lamp configurations and associated lumen output.

1.06 DELIVERY, STORAGE, AND PROTECTION

A. Receive, handle, and store products according to NECA/IESNA 500 (commercial lighting), NECA/IESNA 502 (industrial lighting), and manufacturer's written instructions.

B. Keep products in original manufacturer's packaging and protect from damage until ready for installation.

1.07 FIELD CONDITIONS

A. Maintain field conditions within manufacturer's required service conditions during and after installation.
1.08 WARRANTY
   A. See Section 01 7800 - Closeout Submittals, for additional warranty requirements.
   B. Provide three year manufacturer warranty for all LED luminaires, including drivers.

PART 2 PRODUCTS
2.01 LUMINAIRE TYPES
   A. Furnish products as indicated in luminaire schedule included on the drawings.
   B. Substitutions: See Section 01 6000 - Product Requirements, except where individual luminaire
types are designated with substitutions not permitted.

2.02 LUMINAIRES
   A. Manufacturers:
      8. Substitutions:  See Section 01 6000 - Product Requirements.
   B. Provide products that comply with requirements of NFPA 70.
   C. Provide products that are listed and labeled as complying with UL 1598, where applicable.
   D. Provide products listed, classified, and labeled as suitable for the purpose intended.
   E. Unless otherwise indicated, provide complete luminaires including lamp(s) and all sockets,
      ballasts, reflectors, lenses, housings and other components required to position, energize and
      protect the lamp and distribute the light.
   F. Unless specifically indicated to be excluded, provide all required conduit, boxes, wiring,
      connectors, hardware, supports, trims, accessories, etc. as necessary for a complete operating
      system.
   G. Provide products suitable to withstand normal handling, installation, and service without any
      damage, distortion, corrosion, fading, discoloring, etc.
   H. Recessed Luminaires:
      2. Luminaires Recessed in Insulated Ceilings:  Listed and labeled as IC-rated, suitable for
direct contact with insulation and combustible materials.
      3. Luminaires Recessed in Sloped Ceilings:  Provide suitable sloped ceiling adapters.
      4. Air-Handling Recessed Fluorescent Luminaires:  Suitable for air supply/return, heat
         removal, or combination as indicated.
   I. Fluorescent Luminaires:
      1. Provide ballast disconnecting means complying with NFPA 70 where required.
      2. Fluorescent Luminaires Controlled by Occupancy Sensors:  Provide programmed start
         ballasts.
      3. Fluorescent Luminaires Controlled by Dual-Level Switching:  Provide with two ballasts.
   J. LED Luminaires:
      1. Components:  UL 8750 recognized or listed as applicable.
      2. Tested in accordance with IES LM-79 and IES LM-80.
      3. LED Estimated Useful Life:  Minimum of 50,000 hours at 70 percent lumen maintenance,
calculated based on IES LM-80 test data.
   K. LED Tape Lighting Systems:  Provide all power supplies, drivers, cables, connectors, channels,
      covers, mounting accessories, and interfaces as necessary to complete installation.
1. **LED Tape - General Requirements:**
   a. Listed.
   b. Designed for field cutting in accordance with listing.
   c. Wet Location Applications: IEC 60529, IP 68 (waterproof) rated.

2. **White LED Tape:**
   a. Correlated Color Temperature (CCT): __________ K unless otherwise indicated.
   b. Color Rendering Index (CRI): Not less than 90.

L. **Track Lighting Systems:** Provide track compatible with specified track heads, with all connectors, power feed fittings, dead ends, hangers and canopies as necessary to complete installation.

M. **Luminaires Mounted in Continuous Rows:** Provide quantity of units required for length indicated, with all accessories required for joining and aligning.

### 2.03 EMERGENCY LIGHTING UNITS

A. **Manufacturers:**
   2. Cooper Lighting, a division of Cooper Industries; __________: www.cooperindustries.com/#sle.
   4. Substitutions: See Section 01 6000 - Product Requirements.

B. **Description:** Emergency lighting units complying with NFPA 101 and all applicable state and local codes, and listed and labeled as complying with UL 924.

C. **Operation:** Upon interruption of normal power source or brownout condition exceeding 20 percent voltage drop from nominal, solid-state control automatically switches connected lamps to integral battery power for minimum of 90 minutes of rated emergency illumination, and automatically recharges battery upon restoration of normal power source.

D. **Battery:**
   1. Size battery to supply all connected lamps, including emergency remote heads where indicated.

E. **Diagnostics:** Provide power status indicator light and accessible integral test switch to manually activate emergency operation.

F. **Provide low-voltage disconnect to prevent battery damage from deep discharge.**

G. **Self-Diagnostics:** Provide units that self-monitor functionality and automatically perform testing required by NFPA 101 where indicated; provide indicator light(s) to report test and diagnostic status.

H. **Where indicated, provide units with integral time delay to maintain emergency illumination for 15 minutes after restoration of normal power source.**

I. **Accessories:**
   1. Provide compatible accessory mounting brackets where indicated or required to complete installation.
   2. Provide compatible accessory high impact polycarbonate vandal shields where indicated.
   3. Provide compatible accessory wire guards where indicated.
   4. Where indicated, provide emergency remote heads that are compatible with the emergency lighting unit they are connected to and suitable for the installed location.

### 2.04 EXIT SIGNS

A. **Manufacturers - Powered and Self-Luminous Signs:**
   2. Cooper Lighting, a division of Cooper Industries; __________: www.cooperindustries.com/#sle.
5. Substitutions: See Section 01 6000 - Product Requirements.

B. Manufacturers - Photoluminescent Signs:
1. Substitutions: See Section 01 6000 - Product Requirements.

C. Description: Internally illuminated exit signs with LEDs unless otherwise indicated; complying with NFPA 101 and all applicable state and local codes, and listed and labeled as complying with UL 924.
   1. Number of Faces: Single or double as indicated or as required for the installed location.
   2. Directional Arrows: As indicated or as required for the installed location.

D. Self-Luminous Exit Signs: Internally illuminated by tritium gas sealed inside phosphor lined gas tubes, requiring no electrical power to operate, with a service life of 20 years unless otherwise indicated.

E. Photoluminescent Exit Signs: Powder-coated sheet aluminum with photoluminescent pigmented material.

F. Accessories:
   1. Provide compatible accessory high impact polycarbonate vandal shields where indicated.
   2. Provide compatible accessory wire guards where indicated.

2.05 BALLASTS AND DRIVERS

A. Manufacturers:
   1. Alloy LED; __________; www.alloyled.com/#sle.
   6. Substitutions: See Section 01 6000 - Product Requirements.
   7. Manufacturer Limitations: Where possible, for each type of luminaire provide ballasts produced by a single manufacturer.
   8. Where a specific manufacturer or model is indicated elsewhere in the luminaire schedule or on the drawings, substitutions are not permitted unless explicitly indicated.

B. Ballasts/Drivers - General Requirements:
   1. Provide ballasts containing no polychlorinated biphenyls (PCBs).
   2. Minimum Efficiency/Efficacy: Provide ballasts complying with all current applicable federal and state ballast efficiency/efficacy standards.

C. Fluorescent Ballasts:
   1. All Fluorescent Ballasts: Unless otherwise indicated, provide high frequency electronic ballasts complying with ANSI C82.11 and listed and labeled as complying with UL 935.
      a. Input Voltage: Suitable for operation at voltage of connected source, with variation tolerance of plus or minus 10 percent.
      b. Total Harmonic Distortion: Not greater than 20 percent.
      c. Power Factor: Not less than 0.95.
      d. Ballast Factor: Normal ballast factor between 0.85 and 1.15, unless otherwise indicated.
      e. Thermal Protection: Listed and labeled as UL Class P, with automatic reset for integral thermal protectors.
      f. Sound Rating: Class A, suitable for average ambient noise level of 20 to 24 decibels.
      g. Lamp Compatibility: Specifically designed for use with the specified lamp, with no visible flicker.
      h. Lamp Operating Frequency: Greater than 20 kHz, except as specified below.
i. Lamp Current Crest Factor: Not greater than 1.7.

j. Provide automatic restart capability to restart replaced lamp(s) without requiring resetting of power.

k. Provide end of lamp life automatic shut down circuitry for T5 and smaller diameter lamp ballasts.

l. Surge Tolerance: Capable of withstanding characteristic surges according to IEEE C62.41.2, location category A.

m. Electromagnetic Interference/Radio Frequency Interference (EMI/RFI) Limits: Comply with FCC requirements of 47 CFR 15, for Class A, non-consumer application.

n. Provide high efficiency T8 lamp ballasts certified as NEMA premium where indicated.

o. Ballast Marking: Include wiring diagrams with lamp connections.

D. Dimmable LED Drivers:
   1. Dimming Range: Continuous dimming from 100 percent to five percent relative light output unless dimming capability to lower level is indicated, without flicker.
   2. Control Compatibility: Fully compatible with the dimming controls to be installed.
      a. Wall Dimmers: See Section 26 2726.

2.06 FLUORESCENT EMERGENCY POWER SUPPLY UNITS

A. Manufacturers:
   1. Iota Engineering, LLC; __________: www.iotaengineering.com/#sle.
   2. Lithonia Lighting; __________: www.lithonia.com/#sle.
   4. __________.
   5. Substitutions: See Section 01 6000 - Product Requirements.

B. Description: Self-contained fluorescent emergency power supply units suitable for use with indicated luminaires, complying with NFPA 101 and all applicable state and local codes, and listed and labeled as complying with UL 924.

C. Compatibility:
   1. Ballasts: Compatible with electronic, standard magnetic, energy saving, and dimming AC ballasts, including those with end of lamp life shutdown circuits.

D. Operation: Upon interruption of normal power source, solid-state control automatically switches connected lamp(s) to the fluorescent emergency power supply for minimum of 90 minutes of rated emergency illumination, and automatically recharges battery upon restoration of normal power source.

E. Emergency Illumination Output:
   1. Luminaires with F32T8 Lamps: Operate two lamp(s) at a minimum of 1350 lumens unless otherwise indicated with indicated illumination evenly divided between the lamps.

F. Diagnostics: Provide accessible and visible multi-chromatic combination test switch/indicator light to display charge, test, and diagnostic status and to manually activate emergency operation.

G. Self-Diagnostics: Provide units that self-monitor functionality and automatically perform testing required by NFPA 101 where indicated; provide indicator light(s) to report test and diagnostic status and field selectable audible alert.

H. Operating Temperature: From 32 degrees F (0 degrees C) to 122 degrees F (50 degrees C) unless otherwise indicated or required for the installed location.

I. Accessories:
   1. Provide compatible accessory remote combination test switch/indicator light where indicated.

2.07 LAMPS

A. Manufacturers:
3. Philips Lighting North America Corporation; __________;
   www.usa.lighting.philips.com/#sle.
4. Substitutions: See Section 01 6000 - Product Requirements.
5. Manufacturer Limitations: Where possible, provide lamps produced by a single
   manufacturer.

B. Lamps - General Requirements:
   1. Unless explicitly excluded, provide new, compatible, operable lamps in each luminaire.
   2. Verify compatibility of specified lamps with luminaires to be installed. Where lamps are not
      specified, provide lamps per luminaire manufacturer's recommendations.
   3. Minimum Efficiency: Provide lamps complying with all current applicable federal and state
      lamp efficiency standards.
   4. Color Temperature Consistency: Unless otherwise indicated, for each type of lamp furnish
      products which are consistent in perceived color temperature. Replace lamps that are
      determined by the Architect to be inconsistent in perceived color temperature.

2.08 ACCESSORIES
   A. Stems for Suspended Luminaires: Steel tubing, minimum 1/2” size, factory finished to match
      luminaire or field-painted as directed.
   B. Threaded Rods for Suspended Luminaires: Zinc-plated steel, minimum 1/4” size, field-painted
      as directed.
   C. Provide accessory plaster frames for luminaires recessed in plaster ceilings.
   D. Tube Guards for Linear Fluorescent Lamps: Provide clear virgin polycarbonate sleeves with
      endcaps where indicated.

PART 3 EXECUTION
3.01 EXAMINATION
   A. Verify that field measurements are as indicated.
   B. Verify that outlet boxes are installed in proper locations and at proper mounting heights and are
      properly sized to accommodate conductors in accordance with NFPA 70.
   C. Verify that suitable support frames are installed where required.
   D. Verify that branch circuit wiring installation is completed, tested, and ready for connection to
      luminaires.
   E. Verify that conditions are satisfactory for installation prior to starting work.

3.02 INSTALLATION
   A. Coordinate locations of outlet boxes provided under Section 26 0533.16 as required for
      installation of luminaires provided under this section.
   B. Perform work in accordance with NECA 1 (general workmanship).
   C. Install products in accordance with manufacturer's instructions.
   D. Install luminaires securely, in a neat and workmanlike manner, as specified in NECA 500
      (commercial lighting) and NECA 502 (industrial lighting).
   E. Install luminaires plumb and square and aligned with building lines and with adjacent luminaires.
   F. Suspended Ceiling Mounted Luminaires:
      1. Do not use ceiling tiles to bear weight of luminaires.
      2. Do not use ceiling support system to bear weight of luminaires unless ceiling support system
         is certified as suitable to do so.
      3. Secure surface-mounted and recessed luminaires to ceiling support channels or framing
         members or to building structure.
      4. Secure pendant-mounted luminaires to building structure.
      5. Secure lay-in luminaires to ceiling support channels using listed safety clips at four
         corners.
6. In addition to ceiling support wires, provide two galvanized steel safety wire(s), minimum 12 gage, connected from opposing corners of each recessed luminaire to building structure.

7. See appropriate Division 9 section where suspended grid ceiling is specified for additional requirements.

G. Recessed Luminaires:
   1. Install trims tight to mounting surface with no visible light leakage.
   2. Non-IC Rated Luminaires: Maintain required separation from insulation and combustible materials according to listing.
   3. Luminaires Recessed in Fire-Rated Ceilings: Install using accessories and firestopping materials to meet regulatory requirements for fire rating.

H. Suspended Luminaires:
   1. Unless otherwise indicated, specified mounting heights are to bottom of luminaire.
   2. Install using the suspension method indicated, with support lengths and accessories as required for specified mounting height.
   3. Provide minimum of two supports for each luminaire equal to or exceeding 4 feet nominal length, with no more than 4 feet (1.2 m) between supports.
   4. Install canopies tight to mounting surface.
   5. Unless otherwise indicated, support pendants from swivel hangers.

I. Wall-Mounted Luminaires: Unless otherwise indicated, specified mounting heights are to center of luminaire.

J. Install accessories furnished with each luminaire.

K. Bond products and metal accessories to branch circuit equipment grounding conductor.

L. Air Handling Luminaires: Interface with air handling accessories furnished and installed under Section 23 3600.

M. Fluorescent Luminaires Controlled by Dual-Level Switching: Connect such that each switch controls the same corresponding lamps in each luminaire.

N. Emergency Lighting Units:
   1. Unless otherwise indicated, connect unit to unswitched power from same circuit feeding normal lighting in same room or area. Bypass local switches, contactors, or other lighting controls.
   2. Install lock-on device on branch circuit breaker serving units.

O. Exit Signs:
   1. Unless otherwise indicated, connect unit to unswitched power from same circuit feeding normal lighting in same room or area. Bypass local switches, contactors, or other lighting controls.
   2. Install lock-on device on branch circuit breaker serving units.

P. Fluorescent Emergency Power Supply Units:
   1. For field-installed units, install inside luminaire unless otherwise indicated. Where installation inside luminaire is not possible, install on top of luminaire.
   2. Unless otherwise indicated, connect unit to unswitched power from same circuit feeding normal ballast(s) in luminaire. Bypass local switches, contactors, or other lighting controls.
   3. Install lock-on device on branch circuit breaker serving units.

Q. Remote Ballasts: Install in accessible location as indicated or as required to complete installation, using conductors per manufacturer's recommendations not exceeding manufacturer's recommended maximum conductor length to luminaire.

R. Identify luminaires connected to emergency power system in accordance with Section 26 0553.

S. Install lamps in each luminaire.

T. Lamp Burn-In: Operate lamps at full output for prescribed period per manufacturer's recommendations prior to use with any dimming controls. Replace lamps that fail prematurely due to improper lamp burn-in.
3.03 FIELD QUALITY CONTROL
   A. See Section 01 4000 - Quality Requirements, for additional requirements.
   B. Inspect each product for damage and defects.
   C. Operate each luminaire after installation and connection to verify proper operation.
   D. Test self-powered exit signs, emergency lighting units, and fluorescent emergency power supply units to verify proper operation upon loss of normal power supply.
   E. Correct wiring deficiencies and repair or replace damaged or defective products. Repair or replace excessively noisy ballasts as determined by Architect.

3.04 ADJUSTING
   A. Aim and position adjustable luminaires to achieve desired illumination as indicated or as directed by Architect. Secure locking fittings in place.
   B. Aim and position adjustable emergency lighting unit lamps to achieve optimum illumination of egress path as required or as directed by Architect or authority having jurisdiction.
   C. Exit Signs with Field-Selective Directional Arrows: Set as indicated or as required to properly designate egress path as directed by Architect or authority having jurisdiction.

3.05 CLEANING
   A. Clean surfaces according to NECA 500 (commercial lighting), NECA 502 (industrial lighting), and manufacturer’s instructions to remove dirt, fingerprints, paint, or other foreign material and restore finishes to match original factory finish.

3.06 CLOSEOUT ACTIVITIES
   A. See Section 01 7800 - Closeout Submittals, for closeout submittals.
   B. See Section 01 7900 - Demonstration and Training, for additional requirements.

3.07 PROTECTION
   A. Protect installed luminaires from subsequent construction operations.

3.08 ATTACHMENTS
   A. Luminaire schedule.
   B. Luminaire cut sheets.

END OF SECTION
SECTION 26 5600
EXTERIOR LIGHTING

PART 1 GENERAL

1.01 SECTION INCLUDES
A. Exterior luminaires.
B. Ballasts.
C. Lamps.
D. Poles and accessories.
E. Luminaire accessories.

1.02 RELATED REQUIREMENTS
A. Section 03 3000 - Cast-in-Place Concrete: Materials and installation requirements for concrete bases for poles.
B. Section 26 0526 - Grounding and Bonding for Electrical Systems.
C. Section 26 0533.16 - Boxes for Electrical Systems.
D. Section 26 0919 - Enclosed Contactors: Lighting contactors.
E. Section 26 0923 - Lighting Control Devices: Automatic controls for lighting including outdoor motion sensors, time switches, and outdoor photo controls.
F. Section 26 0943 - Network Lighting Controls - Lutron QS/Quantum.
G. Section 26 2726 - Wiring Devices: Receptacles for installation in poles.
H. Section 26 2813 - Fuses.
I. Section 26 5013 - Luminaire Schedule.
J. Section 26 5100 - Interior Lighting.

1.03 REFERENCE STANDARDS
C. IEC 60529 - Degrees of Protection Provided by Enclosures (IP Code); 2013 (Corrigendum 2015).
H. NECA 1 - Standard for Good Workmanship in Electrical Construction; 2015.
J. NEMA 410 - Performance Testing for Lighting Controls and Switching Devices with Electronic Drivers and Discharge Ballasts; 2016.
K. NEMA LE 4 - Recessed Luminaires, Ceiling Compatibility; 2012.
L. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.
M. UL 935 - Fluorescent-Lamp Ballasts; Current Edition, Including All Revisions.
N. UL 1598 - Luminaires; Current Edition, Including All Revisions.

1.04 ADMINISTRATIVE REQUIREMENTS
A. Coordination:
   1. Coordinate placement of poles and associated foundations with utilities, curbs, sidewalks, trees, walls, fences, striping, etc. installed under other sections or by others. Coordinate elevation to obtain specified foundation height.
   2. Notify Architect of any conflicts or deviations from the contract documents to obtain direction prior to proceeding with work.

1.05 SUBMITTALS
A. See Section 01 3000 - Administrative Requirements, for submittal procedures.
B. Shop Drawings:
   1. Provide photometric calculations where luminaires are proposed for substitution upon request.
C. Product Data: Provide manufacturer's standard catalog pages and data sheets including detailed information on luminaire construction, dimensions, ratings, finishes, mounting requirements, listings, service conditions, photometric performance, weight, effective projected area (EPA), and installed accessories; include model number nomenclature clearly marked with all proposed features.
   1. LED Luminaires:
      a. Include estimated useful life, calculated based on IES LM-80 test data.
      b. Include IES LM-79 test report upon request.
   2. Lamps: Include rated life and initial and mean lumen output.
   3. Poles: Include information on maximum supported effective projected area (EPA) and weight for the design wind speed.
D. Manufacturer's Installation Instructions: Indicate application conditions and limitations of use stipulated by product testing agency. Include instructions for storage, handling, protection, examination, preparation, installation, and starting of product.

1.06 QUALITY ASSURANCE
A. Conform to requirements of NFPA 70.
B. Maintain at the project site a copy of each referenced document that prescribes execution requirements.
C. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years documented experience.

1.07 DELIVERY, STORAGE, AND HANDLING
A. Receive, handle, and store products according to NECA/IESNA 501 and manufacturer's written instructions.
B. Keep products in original manufacturer's packaging and protect from damage until ready for installation.

1.08 WARRANTY
A. See Section 01 7800 - Closeout Submittals, for additional warranty requirements.
B. Provide three year manufacturer warranty for all LED luminaires, including drivers.

PART 2 PRODUCTS
2.01 LUMINAIRE TYPES
A. Furnish products as indicated in luminaire schedule included on the drawings.
B. Substitutions: See Section 01 6000 - Product Requirements.
2.02 LUMINAIRES

A. Manufacturers:
   2. Cooper Lighting, a division of Cooper Industries; __________: www.cooperindustries.com/#sle.
   5. Substitutions: See Section 01 6000 - Product Requirements.

B. Provide products that comply with requirements of NFPA 70.

C. Provide products that are listed and labeled as complying with UL 1598, where applicable.

D. Provide products listed, classified, and labeled as suitable for the purpose intended.

E. Provide products complying with Federal Energy Management Program (FEMP) requirements.

F. Unless otherwise indicated, provide complete luminaires including lamp(s) and all sockets, ballasts, reflectors, lenses, housings and other components required to position, energize and protect the lamp and distribute the light.

G. Unless specifically indicated to be excluded, provide all required conduit, boxes, wiring, connectors, hardware, poles, foundations, supports, trims, accessories, etc. as necessary for a complete operating system.

H. Provide products suitable to withstand normal handling, installation, and service without any damage, distortion, corrosion, fading, discoloring, etc.

I. Provide luminaires listed and labeled as suitable for wet locations unless otherwise indicated.

J. Recessed Luminaires:
   2. Luminaires Recessed in Insulated Ceilings: Listed and labeled as IC-rated, suitable for direct contact with insulation and combustible materials.
   3. Luminaires Recessed in Sloped Ceilings: Provide suitable sloped ceiling adapters.

K. LED Luminaires:
   1. Components: UL 8750 recognized or listed as applicable.
   2. Tested in accordance with IES LM-79 and IES LM-80.
   3. LED Estimated Useful Life: Minimum of 50,000 hours at 70 percent lumen maintenance, calculated based on IES LM-80 test data.

L. LED Tape Lighting Systems: Provide all power supplies, drivers, cables, connectors, channels, covers, mounting accessories, and interfaces as necessary to complete installation.

   1. LED Tape - General Requirements:
      a. Listed.
      b. Designed for field cutting in accordance with listing.
      c. Wet Location Applications: IEC 60529, IP 68 (waterproof) rated.

2.03 BALLASTS

A. Ballasts/Drivers - General Requirements:
   1. Provide ballasts containing no polychlorinated biphenyls (PCBs).
   2. Minimum Efficiency/Efficacy: Provide ballasts complying with all current applicable federal and state ballast efficiency/efficacy standards.

B. Fluorescent Ballasts: Unless otherwise indicated, provide high frequency electronic ballasts complying with ANSI C82.11 and listed and labeled as complying with UL 935.
   1. Input Voltage: Suitable for operation at voltage of connected source, with variation tolerance of plus or minus 10 percent.
   2. Total Harmonic Distortion: Not greater than 20 percent.
3. Power Factor: Not less than 0.95.
4. Ballast Factor: Normal ballast factor between 0.85 and 1.15, unless otherwise indicated.
5. Thermal Protection: Listed and labeled as UL Class P, with automatic reset for integral thermal protectors.
7. Lamp Compatibility: Specifically designed for use with the specified lamp, with no visible flicker.
8. Lamp Operating Frequency: Greater than 20 kHz, except as specified below.
10. Lamp Starting Temperature: Capable of starting standard lamp(s) at a minimum of 0 degrees F (-18 degrees C) unless otherwise indicated.
11. Provide automatic restart capability to restart replaced lamp(s) without requiring resetting of power.
12. Provide end of lamp life automatic shut down circuitry for T5 and smaller diameter lamp ballasts.
13. Surge Tolerance: Capable of withstanding characteristic surges according to IEEE C62.41.2, location category A.

2.04 LAMPS
A. Manufacturers:
2. Osram Sylvania; _________: www.sylvania.com/#sle.
4. Substitutions: See Section 01 6000 - Product Requirements.
5. Manufacturer Limitations: Where possible, provide lamps produced by a single manufacturer.
6. Where a specific manufacturer or model is indicated elsewhere in the luminaire schedule or on the drawings, substitutions are not permitted unless explicitly indicated.

B. Lamps - General Requirements:
1. Unless explicitly excluded, provide new, compatible, operable lamps in each luminaire.
2. Verify compatibility of specified lamps with luminaires to be installed. Where lamps are not specified, provide lamps per luminaire manufacturer’s recommendations.
3. Minimum Efficiency: Provide lamps complying with all current applicable federal and state lamp efficiency standards.
4. Color Temperature Consistency: Unless otherwise indicated, for each type of lamp furnish products which are consistent in perceived color temperature. Replace lamps that are determined by the Architect to be inconsistent in perceived color temperature.

C. Compact Fluorescent Lamps: Wattage and bulb type as indicated, with base type as required for luminaire.
1. Correlated Color Temperature (CCT): 3,500 K unless otherwise indicated.
2. Color Rendering Index (CRI): Not less than 80.

D. Linear Fluorescent Lamps: Wattage and bulb type as indicated, with base type as required for luminaire.

2.05 POLES
A. Manufacturers:
2. Cooper Lighting, a division of Cooper Industries; _________: www.cooperindustries.com/#sle.
4. Philips Lighting North America Corporation; ________;
   www.lightingproducts.philips.com/#sle.
5. Substitutions: See Section 01 6000 - Product Requirements.

B. All Poles:
   1. Provide poles and associated support components suitable for the luminaire(s) and
      associated supports and accessories to be installed.

C. Metal Poles: Provide ground lug, accessible from handhole or transformer base.

2.06 ACCESSORIES
A. Stems for Suspended Luminaires: Steel tubing, minimum 1/2” size, factory finished to match
   luminaire or field-painted as directed.
B. Threaded Rods for Suspended Luminaires: Zinc-plated steel, minimum 1/4” size, field-painted
   as directed.
C. Provide accessory plaster frames for luminaires recessed in plaster ceilings.

PART 3 EXECUTION
3.01 INSTALLATION
A. Coordinate locations of outlet boxes provided under Section 26 0533.16 as required for
   installation of luminaires provided under this section.
B. Perform work in accordance with NECA 1 (general workmanship).
C. Install products in accordance with manufacturer’s instructions.
D. Install luminaires in accordance with NECA/IESNA 501.
E. Install luminaires plumb and square and aligned with building lines and with adjacent luminaires.
F. Recessed Luminaires:
   1. Install trims tight to mounting surface with no visible light leakage.
   2. Non-IC Rated Luminaires: Maintain required separation from insulation and combustible
      materials according to listing.
   3. Luminaires Recessed in Fire-Rated Ceilings: Install using accessories and firestopping
      materials to meet regulatory requirements for fire rating.
G. Suspended Luminaires:
   1. Unless otherwise indicated, specified mounting heights are to bottom of luminaire.
   2. Install using the suspension method indicated, with support lengths and accessories as
      required for specified mounting height.
   3. Provide minimum of two supports for each luminaire equal to or exceeding 4 feet in length,
      with no more than 4 feet (1.2 m) between supports.
   4. Install canopies tight to mounting surface.
   5. Unless otherwise indicated, support pendants from swivel hangers.
H. Wall-Mounted Luminaires: Unless otherwise indicated, specified mounting heights are to center
   of luminaire.
I. Pole-Mounted Luminaires:
   1. Maintain the following minimum clearances:
      b. Comply with utility company requirements.
   2. Foundation-Mounted Poles:
      a. Provide cast-in-place concrete foundations for poles as indicated, in accordance with
         Section 03 3000.
         1) Install anchor bolts plumb per template furnished by pole manufacturer.
         2) Position conduits to enter pole shaft.
      b. Install foundations plumb.
      c. Install poles plumb, using leveling nuts or shims as required to adjust to plumb.
      d. Tighten anchor bolt nuts to manufacturer’s recommended torque.
3. **Grounding:**
   a. Bond luminaires, metal accessories, metal poles, and foundation reinforcement to branch circuit equipment grounding conductor.
4. **Install separate service conductors, 12 AWG copper, from each luminaire down to handhole for connection to branch circuit conductors.**

J. **Install accessories furnished with each luminaire.**
K. **Bond products and metal accessories to branch circuit equipment grounding conductor.**
L. **Install lamps in each luminaire.**

### 3.02 FIELD QUALITY CONTROL

A. **See Section 01 4000 - Quality Requirements, for additional requirements.**
B. **Inspect each product for damage and defects.**
C. **Operate each luminaire after installation and connection to verify proper operation.**
D. **Correct wiring deficiencies and repair or replace damaged or defective products. Repair or replace excessively noisy ballasts as determined by Architect.**

### 3.03 ADJUSTING

A. **Aim and position adjustable luminaires to achieve desired illumination as indicated or as directed by Architect. Secure locking fittings in place.**
B. **Luminaires with Field-Rotatable Optics: Position optics according to manufacturer's instructions to achieve lighting distribution as indicated or as directed by Architect.**

### 3.04 CLEANING

A. **Clean surfaces according to NECA/IESNA 501 and manufacturer's instructions to remove dirt, fingerprints, paint, or other foreign material and restore finishes to match original factory finish.**

### 3.05 CLOSEOUT ACTIVITIES

A. **See Section 01 7800 - Closeout Submittals, for closeout submittals.**
B. **See Section 01 7900 - Demonstration and Training, for additional requirements.**
C. **Demonstration: Demonstrate proper operation of luminaires to Architect, and correct deficiencies or make adjustments as directed.**
D. **Just prior to Substantial Completion, replace all lamps that have failed.**

### 3.06 ATTACHMENTS

A. **Luminaire schedule.**
B. **Luminaire cut sheets.**

**END OF SECTION**
SECTION 28 4600
FIRE DETECTION AND ALARM

PART 1 GENERAL
1.01 SECTION INCLUDES
A. Fire alarm system design and installation, including all components, wiring, and conduit.
B. Transmitters for communication with supervising station.
C. Circuits from protected premises to supervising station, including conduit.

1.02 RELATED REQUIREMENTS
A. Section 07 8400 - Firestopping: Materials and methods for work to be performed by this installer.
B. Section 08 3323 - Overhead Coiling Doors: Coiling fire doors to be released by fire alarm system.
C. Section 08 7100 - Door Hardware: Electrically operated locks and door holder devices to be monitored and released by fire alarm system.
D. Section 14 2100 - Electric Traction Elevators: Elevator systems monitored and controlled by fire alarm system.
E. Section 14 2400 - Hydraulic Elevators: Elevator systems monitored and controlled by fire alarm system.
F. Section ______: Communications receivers and other supervising station components.
G. Section 21 1300 - Fire-Suppression Sprinkler Systems: Supervisory, alarm, and actuating devices installed in sprinkler system.
H. Section 21 2200 - Clean-Agent Fire-Extinguishing System: Supervisory, alarm, and releasing devices installed in extinguishing system.
I. Section 21 3000 - Fire Pumps: Supervisory devices.
J. Section 23 3300 - Air Duct Accessories: Smoke dampers monitored and controlled by fire alarm system.
K. Section 27 5129.13 - Area of Refuge/Rescue Assistance Systems: Two-way emergency communication systems for areas of refuge/rescue assistance.

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

1.04 SUBMITTALS
A. See Section 01 3000 - Administrative Requirements, for submittal procedures.
B. Proposal Documents: Submit the following with cost/time proposal:
1. NFPA 72 "Record of Completion", filled out to the extent known at the time.
2. Manufacturer's detailed data sheet for each control unit, initiating device, and notification appliance.
3. Certification by Contractor that the system design will comply with the contract documents.

C. Drawings must be prepared using AutoCAD Release ____.
   1. Owner will provide floor plan drawings for Contractor's use; verify all dimensions on Owner-provided drawings.

D. Evidence of designer qualifications.

E. Design Documents: Submit all information required for plan review and permitting by authorities having jurisdiction, including but not limited to floor plans, riser diagrams, and description of operation:
   1. Copy (if any) of list of data required by authority having jurisdiction.
   2. NFPA 72 "Record of Completion", filled out to the extent known at the time.
   3. Clear and concise description of operation, with input/output matrix similar to that shown in NFPA 72 Appendix A-7-5-2.2(9), and complete listing of software required.
   4. System zone boundaries and interfaces to fire safety systems.
   5. Location of all components, circuits, and raceways; mark components with identifiers used in control unit programming.
   6. Circuit layouts; number, size, and type of raceways and conductors; conduit fill calculations; spare capacity calculations; notification appliance circuit voltage drop calculations.
   7. List of all devices on each signaling line circuit, with spare capacity indicated.
   8. Manufacturer's detailed data sheet for each component, including wiring diagrams, installation instructions, and circuit length limitations.
   9. Air-Sampling Smoke Detection Systems: Include air-sampling pipe network layout with sampling ports identified; include calculations demonstrating compliance with specified requirements.
   10. Description of power supplies; if secondary power is by battery include calculations demonstrating adequate battery power.
   11. Detailed drawing of graphic annunciator(s).
   12. Certification by either the manufacturer of the control unit or by the manufacturer of each other component that the components are compatible with the control unit.
   13. Certification by the manufacturer of the control unit that the system design complies with the contract documents.
   14. Certification by Contractor that the system design complies with the contract documents.

F. Evidence of installer qualifications.

G. Evidence of instructor qualifications; training lesson plan outline.

H. Evidence of maintenance contractor qualifications, if different from installer.

I. Inspection and Test Reports:
   1. Submit inspection and test plan prior to closeout demonstration.
   2. Submit documentation of satisfactory inspections and tests.
   3. Submit NFPA 72 "Inspection and Test Form," filled out.

J. Operating and Maintenance Data: See Section 01 7800 for additional requirements; revise and resubmit until acceptable; have one set available during closeout demonstration:
   1. Complete set of specified design documents, as approved by authority having jurisdiction.
   2. Additional printed set of project record documents and closeout documents, bound or filed in same manuals.
   3. Contact information for firm that will be providing contract maintenance and trouble call-back service.
   4. List of recommended spare parts, tools, and instruments for testing.
   5. Replacement parts list with current prices, and source of supply.
6. Detailed troubleshooting guide and large scale input/output matrix.
7. Preventive maintenance, inspection, and testing schedule complying with NFPA 72; provide printed copy and computer format acceptable to Owner.
8. Detailed but easy to read explanation of procedures to be taken by non-technical administrative personnel in the event of system trouble, when routine testing is being conducted, for fire drills, and when entering into contracts for remodeling.

K. Project Record Documents:  See Section 01 7800 for additional requirements; have one set available during closeout demonstration:
1. Complete set of floor plans showing actual installed locations of components, conduit, and zones.
2. "As installed" wiring and schematic diagrams, with final terminal identifications.
3. "As programmed" operating sequences, including control events by device, updated input/output chart, and voice messages by event.

L. Closeout Documents:
1. Certification by manufacturer that the system has been installed in compliance with manufacturer's installation requirements, is complete, and is in satisfactory operating condition.
2. NFPA 72 “Record of Completion”, filled out completely and signed by installer and authorized representative of authority having jurisdiction.

M. Maintenance Materials, Tools, and Software: Furnish the following for Owner's use in maintenance of project.
1. Furnish spare parts of same manufacturer and model as those installed; deliver in original packaging, labeled in same manner as in operating and maintenance data and place in spare parts cabinet.

1.05 QUALITY ASSURANCE
A. Copies of Design Criteria Documents: Maintain at the project site for the duration of the project, bound together, an original copy of NFPA 72, the relevant portions of applicable codes, and instructions and guidelines of authorities having jurisdiction; deliver to Owner upon completion.
B. Designer Qualifications: NICET Level III or IV (3 or 4) certified fire alarm technician or registered fire protection engineer, employed by fire alarm control panel manufacturer, Contractor, or installer, with experience designing fire alarm systems in the jurisdictional area of the authorities having jurisdiction.
C. Installer Qualifications: Firm with minimum 3 years documented experience installing fire alarm systems of the specified type and providing contract maintenance service as a regular part of their business.
1. Authorized representative of control unit manufacturer; submit manufacturer's certification that installer is authorized; include name and title of manufacturer's representative making certification.
2. Installer Personnel: At least 2 years of experience installing fire alarm systems.
3. Supervisor: NICET level III or IV (3 or 4) certified fire alarm technician; furnish name and address.
4. Certified in the State in which the Project is located as fire alarm installer.
D. Maintenance Contractor Qualifications: Same entity as installer or different entity with specified qualifications.
E. Instructor Qualifications: Experienced in technical instruction, understanding fire alarm theory, and able to provide the required training; trained by fire alarm control unit manufacturer.

1.06 WARRANTY
A. See Section 01 7800 - Closeout Submittals, for additional warranty requirements.
B. Provide control panel manufacturer's warranty that system components other than wire and conduit are free from defects and will remain so for 1 year after date of Substantial Completion.

C. Provide installer's warranty that the installation is free from defects and will remain so for 1 year after date of Substantial Completion.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Fire Alarm Control Units and Accessories - Basis of Design: Potter Electric Signal Company, as indicated under product descriptions below; www.pottersignal.com/#sl.

B. Fire Alarm Control Units and Accessories - Other Acceptable Manufacturers:
   5. Simplex, a Tyco Business; ______: www.simplex-fire.com/#sl.
   6. Provide control units made by the same manufacturer.

C. Initiating Devices and Notification Appliances:
   5. Simplex, a Tyco Business; ______: www.simplex-fire.com/#sl.
   6. ________
   7. Same manufacturer as control units.
   8. Provide initiating devices and notification appliances made by the same manufacturer, where possible.

D. Substitutions: See Section 01 6000 - Product Requirements.
   1. For other acceptable manufacturers of control units specified, submit product data showing equivalent features and compliance with contract documents.
   2. For substitution of products by manufacturers not listed, submit product data showing features and certification by Contractor that the design will comply with contract documents.

2.02 FIRE ALARM SYSTEM

A. Fire Alarm System: Provide a new automatic fire detection and alarm system:
   1. Provide all components necessary, regardless of whether shown in the contract documents or not.
   2. Protected Premises: Entire building shown on drawings.
   3. Comply with the following; where requirements conflict, order of precedence of requirements is as listed:
      a. ADA Standards.
      b. The requirements of the State Fire Marshal.
      c. The requirements of the local authority having jurisdiction, which is ________.
      d. Applicable local codes.
      e. The contract documents (drawings and specifications).
      g. NFPA 72; where the word "should" is used consider that provision mandatory; where conflicts between requirements require deviation from NFPA 72, identify deviations clearly on design documents.
   4. Evacuation Alarm: Multiple smoke zones; allow for evacuation notification of any individual zone or combination of zones, in addition to general evacuation of entire premises.
6. General Evacuation Zones: Each smoke zone is considered a general evacuation zone unless otherwise indicated, with alarm notification in all zones on the same floor, on the floor above, and the floor below.
7. Staff Response Zones: For each smoke zone where occupants are not ambulatory, program notification zone as directed to notify staff in areas outside the normal notification zone and in other buildings, for response to assist in evacuation.
8. Program notification zones and voice messages as directed by Owner.
9. Hearing Impaired Occupants: Provide visible notification devices in all public areas and in dwelling units.
10. Fire Command Center: Location indicated on drawings.
11. Fire Alarm Control Unit: New, located at fire command center.
12. Two-Way Telephone: Provide two-way telephone service for the use of the fire service and others; provide jacks and two portable handsets.
13. Guard's Tour: Provide guard's tour supervisory service in accordance with NFPA 601.
14. Combined Systems: Do not combine fire alarm system with other non-fire systems.

B. Supervising Stations and Fire Department Connections:
1. Public Fire Department Notification: By on-premises supervising station.
2. On-Premises Supervising Station: Existing proprietary station operated by Owner, located at ______.
3. Means of Transmission to On-Premises Supervising Station: Directly connected noncoded system.
5. Auxiliary Connection Type: Local energy.

C. Circuits:
1. Initiating Device Circuits (IDC): Class B, Style A.
2. Signaling Line Circuits (SLC) Within Single Building: Class B, Style 0.5.
4. Notification Appliance Circuits (NAC): Class B, Style W.

D. Spare Capacity:
1. Initiating Device Circuits: Minimum 25 percent spare capacity.
4. Fire Alarm Control Units: Capable of handling all circuits utilized to capacity without requiring additional components other than plug-in control modules.

E. Power Sources:
1. Primary: Dedicated branch circuits of the facility power distribution system.
2. Secondary: Storage batteries.
3. Capacity: Sufficient to operate entire system for period specified by NFPA 72.

2.03 FIRE SAFETY SYSTEMS INTERFACES
A. Supervision: Provide supervisory signals in accordance with NFPA 72 for the following:
1. Sprinkler water control valves.
2. Dry-pipe sprinkler system pressure.
3. Dry-pipe sprinkler valve room low temperature.
B. Alarm: Provide alarm initiation in accordance with NFPA 72 for the following:
1. Sprinkler water flow.
C. Elevators:
1. Elevator lobby, hoistway, and machine room smoke detectors: Elevator recall for fire fighters’ service.
2. Elevator Machine Room Heat Detector: Shut down elevator power prior to hoistway sprinkler activation.
3. Sprinkler pressure or waterflow: Shut down elevator power prior to hoistway sprinkler activation.

D. HVAC:
1. Duct Smoke Detectors: Close dampers indicated; shut down air handlers indicated.

E. Doors:
1. Smoke Barrier Door Magnetic Holders: Release upon activation of smoke detectors in smoke zone on either side of door, upon alarm from manual pull station on same floor, and upon sprinkler activation on same floor. Refer to Section 08 7100.
2. Electromagnetic Door Locks on Egress Doors: Unlock upon activation of any alarm initiating device or suppression system in smoke zone that doors serve as egress from. Refer to Section 08 7100.
3. Overhead Coiling Fire Doors: Release upon activation of smoke detectors in smoke zone on either side of door, upon alarm from manual pull station on same floor, and upon sprinkler activation on same floor. Refer to Section 08 3323.

2.04 COMPONENTS

A. General:
1. Provide flush mounted units where installed in finish areas; in unfinished areas, surface mounted unit are acceptable.
2. Provide legible, permanent labels for each control device, using identification used in operation and maintenance data.

B. Fire Alarm Control Units: Analog, addressable type; listed, classified, and labeled as suitable for the purpose intended.

C. Addressable Fire Alarm Control Unit - Basis of Design: Potter Electric Signal Company; IPA Series; Model IPA-4000; www.pottersignal.com/#sle.
1. System Capacity: 4,064 addresses; six (expandable to 192) notification appliance circuits (NACs); four input/output (I/O) circuits; 1,500 software zones.
2. Features: Strobe synchronization; dedicated alarm, supervisory and trouble relays; 4,000 event history buffer; built-in IP communicator; Ethernet port for programming and network connectivity; e-mail system status, reports and event information.

D. Master Control Unit: As specified for Basis of Design above, or equivalent.
1. Printer: ________.

E. Remote Annunciators: ________.

F. Initiating Devices:
1. Addressable Systems:
   a. Addressable Devices: Individually identifiable by addressable fire alarm control unit.
   b. Provide suitable addressable interface modules as indicated or as required for connection to conventional (non-addressable) devices and other components that provide a dry closure output.
   a. Provide 1 extra.
3. Key Operated Pull Stations: ________.
   a. Provide 1 extra.
4. Smoke Detectors: ________.
   a. Provide 1 extra.
5. Duct Smoke Detectors: ________.
   a. Provide 1 extra.
6. Heat Detectors: ________.
   a. Provide 1 extra.
7. Air-Sampling Smoke Detection Systems:
   a. Basis of Design: ________.
   b. Design and provide smoke detection system suitable for application and coverage area indicated, consisting of smoke detector unit with aspirator/fan that continuously
draws air into sensing chamber through connected sampling pipe network and associated sampling ports.

c. Comply with NFPA 72 and list and label as complying with UL 268.
d. Comply with applicable requirements of NFPA 76 for Very Early Warning Fire Detection (VEWFD).
e. Detector Unit:
   1) Sensitivity: Programmable; capable of meeting NFPA 76 requirements for Very Early Warning Fire Detection (VEWFD).
      (a) Sensitivity Range: _____ percent obscuration per foot (_____ percent obscuration per m).
   2) Smoke Detection Method: Provide detector units employing laser-based light scattering mass detection.
   3) Alarm Levels: Programmable; as indicated or as required to perform alert, pre-alarm action, and alarm functions; minimum of three.
   4) Minimum Number of Output Relays Supported: Equivalent to basis of design.
   5) Display: Provides local annunciation of detector trouble and alarm status.

f. Sampling Pipe Network:
   1) Use manufacturer's recommended sampling pipe and fittings; plenum rated; identified in accordance with NFPA 72.
   2) Designed using manufacturer's product-specific design software or based on manufacturer's pre-engineered design suitable for the application.

g. Other Acceptable Products:
   1) Xtralis; VESDA Aspirating Smoke Detection; ______: www.xtralis.com/#sle.
   2) _______.

8. Addressable Interface Devices: _______.
   a. Provide 1 extra.

G. Notification Appliances:
   1. Bells: _______.
      a. Provide 1 extra.
   2. Speakers: _______.
      a. Provide 1 extra.
   3. Strobes: _______.
      a. Provide 1 extra.

H. Circuit Conductors: Copper or optical fiber; provide 200 feet (60 m) extra; color code and label.

I. Surge Protection: In accordance with IEEE C62.41.2 category B combination waveform and NFPA 70; except for optical fiber conductors.
   1. Equipment Connected to Alternating Current Circuits: Maximum let through voltage of 350 V(ac), line-to-neutral, and 350 V(ac), line-to-line; do not use fuses.
   2. Initiating Device Circuits, Notification Appliance Circuits, and Communications Circuits: Provide surge protection at each point where circuit exits or enters a building; rated to protect applicable equipment; for 24 V(dc) maximum dc clamping voltage of 36 V(dc), line-to-ground, and 72 V(dc), line-to-line.
   3. Signaling Line Circuits: Provide surge protection at each point where circuit exits or enters a building, rated to protect applicable equipment.

J. Locks and Keys: Deliver keys to Owner.
   1. Provide the same standard lock and key for each key operated switch and lockable panel and cabinet; provide 5 keys of each type.

K. Instruction Charts: Printed instruction chart for operators, showing steps to be taken when a signal is received (normal, alarm, supervisory, and trouble); easily readable from normal operator’s station.
   1. Frame: Stainless steel or aluminum with polycarbonate or glass cover.
   2. Provide one for each control unit where operations are to be performed.
   3. Obtain approval of Owner prior to mounting; mount in location acceptable to Owner.
4. Provide extra copy with operation and maintenance data submittal.

L. Storage Cabinet for Spare Parts and Tools: Steel with baked enamel finish, size appropriate to quantity of parts and tools.
   1. Padlock eye and hasp for lock furnished by Owner.
   2. Locate as directed by Owner.

PART 3 EXECUTION

3.01 INSTALLATION

A. Install in accordance with applicable codes, NFPA 72, NFPA 70, and the contract documents.
B. Conceal all wiring, conduit, boxes, and supports where installed in finished areas.
C. Obtain Owner's approval of locations of devices, before installation.
D. Install instruction cards and labels.

3.02 INSPECTION AND TESTING FOR COMPLETION

A. Notify Owner 7 days prior to beginning completion inspections and tests.
B. Owner will provide the services of an independent fire alarm engineer or technician to observe all tests.
C. Notify authorities having jurisdiction and comply with their requirements for scheduling inspections and tests and for observation by their personnel.
D. Provide the services of the installer's supervisor or person with equivalent qualifications to supervise inspection and testing, correction, and adjustments.
E. Prepare for testing by ensuring that all work is complete and correct; perform preliminary tests as required.
F. Provide all tools, software, and supplies required to accomplish inspection and testing.
G. Perform inspection and testing in accordance with NFPA 72 and requirements of local authorities; document each inspection and test.
H. Correct defective work, adjust for proper operation, and retest until entire system complies with contract documents.
I. Diagnostic Period: After successful completion of inspections and tests, Operate system in normal mode for at least 14 days without any system or equipment malfunctions.
   1. Record all system operations and malfunctions.
   2. If a malfunction occurs, start diagnostic period over after correction of malfunction.
   3. Owner will provide attendant operator personnel during diagnostic period; schedule training to allow Owner personnel to perform normal duties.
   4. At end of successful diagnostic period, fill out and submit NFPA 72 "Inspection and Testing Form."

3.03 OWNER PERSONNEL INSTRUCTION

A. Provide the following instruction to designated Owner personnel:
   2. Classroom Instruction: Owner furnished classroom, on-site or at other local facility.
B. Administrative: One-hour session(s) covering issues necessary for non-technical administrative staff; classroom:
   1. Initial Training: 1 session pre-closeout.
   2. Refresher Training: 1 session post-occupancy.
C. Basic Operation: One-hour sessions for attendant personnel, security officers, and engineering staff; combination of classroom and hands-on:
   1. Initial Training: 1 session pre-closeout.
   2. Refresher Training: 1 session post-occupancy.
D. Furnish the services of instructors and teaching aids; have copies of operation and maintenance data available during instruction.
E. Provide means of evaluation of trainees suitable to type of training given; report results to Owner.

3.04 CLOSEOUT

A. Closeout Demonstration: Demonstrate proper operation of all functions to Owner.
   1. Be prepared to conduct any of the required tests.
   2. Have at least one copy of operation and maintenance data, preliminary copy of project record drawings, input/output matrix, and operator instruction chart(s) available during demonstration.
   3. Have authorized technical representative of control unit manufacturer present during demonstration.
   4. Demonstration may be combined with inspection and testing required by authority having jurisdiction; notify authority having jurisdiction in time to schedule demonstration.
   5. Repeat demonstration until successful.

B. Occupancy of the project will not occur prior to Substantial Completion.

C. Substantial Completion of the project cannot be achieved until inspection and testing is successful and:
   1. Specified diagnostic period without malfunction has been completed.
   2. Approved operating and maintenance data has been delivered.
   3. Spare parts, extra materials, and tools have been delivered.
   4. All aspects of operation have been demonstrated to Owner.
   5. Final acceptance of the fire alarm system has been given by authorities having jurisdiction.
   6. Occupancy permit has been granted.
   7. Specified pre-closeout instruction is complete.

D. Perform post-occupancy instruction within 3 months after Substantial Completion.

3.05 MAINTENANCE

A. See Section 01 7000 - Execution and Closeout Requirements, for additional requirements relating to maintenance service.

B. Perform routine inspection, testing, and preventive maintenance required by NFPA 72, including:
   1. Maintenance of fire safety interface and supervisory devices connected to fire alarm system.
   2. Repairs required, unless due to improper use, accidents, or negligence beyond the control of the maintenance contractor.
   3. Record keeping required by NFPA 72 and authorities having jurisdiction.

C. Provide trouble call-back service upon notification by Owner:
   1. Provide on-site response within 2 hours of notification.
   2. Include allowance for call-back service during normal working hours at no extra cost to Owner.
   3. Owner will pay for call-back service outside of normal working hours on an hourly basis, based on actual time spent at site and not including travel time; include hourly rate and definition of normal working hours in maintenance contract.

D. Provide a complete description of preventive maintenance, systematic examination, adjustment, cleaning, inspection, and testing, with a detailed schedule.

E. Maintain a log at each fire alarm control unit, listing the date and time of each inspection and call-back visit, the condition of the system, nature of the trouble, correction performed, and parts replaced. Submit duplicate of each log entry to Owner's representative upon completion of site visit.

F. Comply with Owner's requirements for access to facility and security.

END OF SECTION