TECHNICAL SPECIFICATIONS

OWNER: CITY OF COLLEGE PARK

DEPARTMENT: FIRE DEPARTMENT

TEL: (404) 766-8248

PROJECT NAME: COLLEGE PARK FIRE STATION #3

PROJECT ADDRESS: W. Fayetteville Road
College Park, GA 30337

VOLUME I OF I

June 30, 2016

Architect:

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INTRODUCTORY INFORMATION

00001  PROJECT TITLE PAGE
00010  TABLE OF CONTENTS
00030  LIST OF DRAWINGS

BIDDING REQUIREMENTS
Bidding Requirements (including Invitation to Bids, Instructions to Bidders, and Bid Forms) are issued by the Owner under separate cover and are not included in the Project Manual.

CONTRACTING REQUIREMENTS
Contracting Requirements (including Agreement, General Conditions, Bond, and Certificate Forms) are issued by the Owner under separate cover and are not included in the Project Manual.

INDEX OF TECHNICAL SPECIFICATIONS
DIVISION 01  GENERAL REQUIREMENTS
01100  SUMMARY OF WORK
01210  COORDINATION
01250  APPLICATIONS FOR PAYMENT
01310  PROJECT MEETINGS
01330  SUBMITTALS
01400  QUALITY CONTROL
01450  INFORMATION TECHNOLOGY COORDINATION
01500  TEMPORARY FACILITIES AND CONTROLS
01600  PRODUCT REQUIREMENTS
01631  SUBSTITUTIONS
01731  CUTTING AND PATCHING
01739  CLEANING
01740  WARRANTIES
01770  PROJECT CLOSEOUT
01790  WARRANTY AND PROJECT RECORDS COMPILED FOR OWNERS DATABASE

DIVISION 02  SITE WORK
02110  SITE CLEARING
02120  EARTH MOVING
02123  DEWATERING
02212  ASPHALT PAVING
02213  FACILITY SANITARY SEWER
02361  TERMITE CONTROL
02665  WATER DISTRIBUTION
02700  SEWAGE AND DRAINAGE
02768  TACTILE WARNING SYSTEMS
02831  CHAIN LINK FENCES AND GATES

DIVISION 03  CONCRETE
03050  SLIP-RESISTANT CONCRETE SEALER
03150  CONCRETE FORMWORK
03200  CONCRETE REINFORCEMENT
03300  CAST-IN-PLACE-CONCRETE
03450  PLANT-PRECAST ARCHITECTURAL CONCRETE

DIVISION 04  MASONRY
04200  UNIT MASONRY ASSEMBLIES
DIVISION 05  METALS
05120  STRUCTURAL STEEL
05220  STEEL JOIST
05300  STEEL DECK
05400  COLD FORMED METAL FRAMING
05500  METAL FABRICATIONS
05515  ALUMINUM LADDERS
05580  STAINLESS STEEL COUNTERTOPS

DIVISION 06  WOODS AND PLASTICS
06100  ROUGH CARPENTRY
06200  FINISHED CARPENTRY
06400  ARCHITECTURAL WOODWORK
06650  SOLID SURFACING

DIVISION 07  THERMAL AND MOISTURE PROTECTION
07110  BITUMINOUS DAMPPROOFING
07180  WATER REPELLENTS
07210  BUILDING INSULATION
07241  EXTERIOR INSULATION AND FINISH SYSTEM – ON MASONRY
07243  EXTERIOR INSULATION AND FINISH SYSTEM – ON SHEATHING
07412  METAL ROOF PANELS
07500  MEMBRANE ROOFING
07611  SHEET METAL SOFFIT
07620  SHEET METAL FLASHING AND TRIM
07700  ROOF ACCESSORIES
07711  GUTTERS AND DOWNSPOUTS
07840  FIRESTOPPING
07901  JOINT SEALANTS

DIVISION 08  DOORS AND WINDOWS
08110  STEEL DOORS AND FRAMES
08211  FLUSH WOOD DOORS
08310  ACCESS DOOR AND PANELS
08365  EXTERIOR SWINGING FOUR-FOLD DOORS SYSTEM
08411  ALUMINUM FRAMED ENTRANCES AND STOREFRONTS
08520  ALUMINUM WINDOWS
08710  DOOR HARDWARE
08800  GLAZING

DIVISION 09  FINISHES
09250  GYPSUM BOARD ASSEMBLIES
09310  CERAMIC TILE
09445  SEAMLESS EPOXY FLOORING
09511  ACOUSTICAL CEILING TILE
09655  RESILIENT BASE AND ACCESSORIES
09680  CARPET
09900  PAINTING

DIVISION 10  SPECIALTIES
10155  TOILET COMPARTMENTS
10210  WALL LOUVERS
10350  FLAGPOLES
<table>
<thead>
<tr>
<th>SECTION</th>
<th>TABLE OF CONTENTS</th>
</tr>
</thead>
<tbody>
<tr>
<td>10425</td>
<td>SIGNS</td>
</tr>
<tr>
<td>10440</td>
<td>FIRE PROTECTION SPECIALTIES</td>
</tr>
<tr>
<td>10513</td>
<td>METAL LOCKERS</td>
</tr>
<tr>
<td>10800</td>
<td>TOILET ACCESSORIES</td>
</tr>
<tr>
<td>DIVISION 11</td>
<td>EQUIPMENT</td>
</tr>
<tr>
<td>11451</td>
<td>RESIDENTIAL AND COMMERCIAL APPLIANCES</td>
</tr>
<tr>
<td>DIVISION 12</td>
<td>FURNISHINGS</td>
</tr>
<tr>
<td>12511</td>
<td>HORIZONTAL LOUVER BLINDS</td>
</tr>
<tr>
<td>DIVISION 13</td>
<td>SPECIAL CONSTRUCTION</td>
</tr>
<tr>
<td></td>
<td>NOT USED</td>
</tr>
<tr>
<td>DIVISION 14</td>
<td>CONVEYING SYSTEMS</td>
</tr>
<tr>
<td></td>
<td>NOT USED</td>
</tr>
<tr>
<td>DIVISION 15</td>
<td>MECHANICAL</td>
</tr>
<tr>
<td>15000</td>
<td>HVAC GENERAL</td>
</tr>
<tr>
<td>15020</td>
<td>DUCTWORK AND ACCESSORIES</td>
</tr>
<tr>
<td>15030</td>
<td>LOUVERS, GRILLES, REGISTERS AND DIFFUSERS</td>
</tr>
<tr>
<td>15041</td>
<td>CARBON MONOXIDE EXHAUST SYSTEM (UNDERFLOOR)</td>
</tr>
<tr>
<td>15051</td>
<td>NOISE AND VIBRATION CONTROL</td>
</tr>
<tr>
<td>15055</td>
<td>SPLIT SYSTEM AIR CONDITIONING</td>
</tr>
<tr>
<td>15060</td>
<td>REFRIGERANT PIPING</td>
</tr>
<tr>
<td>15135</td>
<td>SINGLE PACKAGE ROOFTOP HEAT PUMPS</td>
</tr>
<tr>
<td>15150</td>
<td>AUTOMATIC CONTROLS</td>
</tr>
<tr>
<td>15151</td>
<td>SEQUENCE OF OPERATIONS FOR HVAC CONTROLS</td>
</tr>
<tr>
<td>15170</td>
<td>HVAC INSULATION</td>
</tr>
<tr>
<td>15175</td>
<td>ENERGY RECOVERY DEHUMIDIFICATION UNIT (HEAT PIPE)</td>
</tr>
<tr>
<td>15180</td>
<td>KITCHEN VENTILATION EQUIPMENT</td>
</tr>
<tr>
<td>15400</td>
<td>PLUMBING GENERAL</td>
</tr>
<tr>
<td>15450</td>
<td>PLUMBING FIXTURES</td>
</tr>
<tr>
<td>15500</td>
<td>FIRE PROTECTION GENERAL</td>
</tr>
<tr>
<td>15605</td>
<td>ELECTRIC WALL HEATERS</td>
</tr>
<tr>
<td>15830</td>
<td>UNITARY EXHAUST AND SUPPLY FANS AND VENTILATORS</td>
</tr>
<tr>
<td>15855</td>
<td>ROOF CURBS</td>
</tr>
<tr>
<td>15911</td>
<td>FIRE-RESISTIVE 3M FIREMASTER® DUCT WRAP</td>
</tr>
<tr>
<td>15950</td>
<td>TESTING, ADJUSTING AND BALANCING (TAB)</td>
</tr>
<tr>
<td>DIVISION 16</td>
<td>ELECTRICAL</td>
</tr>
<tr>
<td>16000</td>
<td>ELECTRICAL GENERAL</td>
</tr>
<tr>
<td>16110</td>
<td>CONDUIT AND RACEWAYS</td>
</tr>
<tr>
<td>16115</td>
<td>FIRESTOPPING FOR ELECTRICAL SYSTEMS</td>
</tr>
<tr>
<td>16120</td>
<td>CONDUCTORS</td>
</tr>
<tr>
<td>16130</td>
<td>OUTLET BOXES AND JUNCTION BOXES</td>
</tr>
<tr>
<td>16140</td>
<td>WIRING DEVICES</td>
</tr>
<tr>
<td>16160</td>
<td>PANELBOARDS</td>
</tr>
<tr>
<td>16170</td>
<td>DISCONNECT SWITCHES</td>
</tr>
<tr>
<td>16250</td>
<td>EMERGENCY STANDBY GENERATOR SYSTEM AND SWITCHING</td>
</tr>
<tr>
<td>16400</td>
<td>SURGE PROTECTIVE DEVICES (SPD)</td>
</tr>
<tr>
<td>16450</td>
<td>GROUNDING</td>
</tr>
<tr>
<td>Code</td>
<td>Description</td>
</tr>
<tr>
<td>------</td>
<td>--------------------------------------------</td>
</tr>
<tr>
<td>16500</td>
<td>LIGHTING</td>
</tr>
<tr>
<td>16520</td>
<td>OCCUPANCY SENSORS</td>
</tr>
<tr>
<td>16700</td>
<td>FIRE ALARM SYSTEM (ADDRESSABLE)</td>
</tr>
<tr>
<td>16750</td>
<td>LOW VOLTAGE BACKBOARDS &amp; ENCLOSURES</td>
</tr>
</tbody>
</table>

END OF TABLE OF CONTENTS
LIST OF DRAWINGS

TS1 TITLE SHEET AND PROJECT INFORMATION

CIVIL
C1 COVER SHEET
C2 EX. CONDITIONS/Demolition Plan
C3 SITE PLAN
C4 GRADING PLAN
C5 STORM SEWER PROFILE & PIE CHART
C6 UTILITY PLAN
C7 LANDSCAPE PLAN
C8 INITIAL PERIMETER ES&PC PLAN
C9 INTERMEDIATE ES&PC PLAN
C10 FINAL ES&PC PLAN
C11 EROSION CONTROL PLAN & DETAILS
C12 TEMPORARY SEDIMENT POND PLAN
C13 WATER QUALITY POND-PLAN & DETAILS
C14 NPDES NOTES
C15 CONSTRUCTION DETAILS
C16 CONSTRUCTION DETAILS
C17 WATER & SEWER DETAILS

STRUCTURAL
S1.0 GENERAL NOTES
S2.0 FOUNDATION PLAN
S2.1 ROOF FRAMING PLAN
S3.0 WALL SECTIONS
S3.1 SECTIONS
S3.2 SECTIONS

ARCHITECTURAL
A0.0 LIFE SAFETY PLAN
A1.0 FLOOR PLAN
A1.1 REFERENCE FLOOR PLAN
A1.2 FLOOR FINISH PLAN AND SCHEDULE
A1.3 REFLECTED CEILING PLAN
A1.4 ROOF PLAN AND DETAILS
A2.0 EXTERIOR ELEVATIONS
A2.1 INTERIOR AND EXTERIOR DETAILS
A3.0 BUILDING SECTIONS
A3.1 WALL SECTIONS
A3.2 WALL SECTIONS
A4.0 ENLARGED FLOOR PLANS
A4.1 INTERIOR ELEVATIONS
A4.2 MILLWORK SECTION AND DETAILS
A5.0 SIGNAGE
A6.0 DOOR SCHEDULE
A6.1 DOOR AND WINDOW DETAILS

MECHANICAL
M0.1 SCHEDULES & LEGENDS - HVAC
M0.2 DETAILS – HVAC
INTRODUCTORY INFORMATION

LIST OF DRAWINGS

PLUMBING

M0.3 NOTES - HVAC
M1.1 FLOOR PLAN - HVAC
M1.2 ROOF PLAN - HVAC

M1.0 FLOOR PLAN - SANITARY - PLUMBING
M1.1 FLOOR PLAN - WATER - PLUMBING
M1.2 ROOF PLAN PLUMBING

ELECTRICAL

P0.0 FLOOR PLAN PLUMBING
P0.1 GENERAL NOTES - PLUMBING
P0.2 SCHEDULES - PLUMBING
P1.0 FLOOR PLAN - SANITARY - PLUMBING
P1.1 FLOOR PLAN - WATER - PLUMBING
P1.2 ROOF PLAN PLUMBING

P1.0 FLOOR PLAN - SANITARY - PLUMBING
P1.1 FLOOR PLAN - WATER - PLUMBING

END OF SECTION
PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 REFERENCES AND STANDARDS

A. Applicability: The publications listed in the paragraphs of an individual section shall apply only to the extent referenced within the text of that section. Unless the Contract Documents include more stringent requirements, applicable construction industry standards form a part of these specifications and have the same force and effect as if bound or copied directly into the Contract Documents. Publications are referenced within the text by the basic designation only.

B. Copies of Standards: Owner or the Architect will not provide copies of references cited within the specifications. Copies may be obtained directly from publication source.

1.3 DEFINITIONS

A. Furnish: Purchase and deliver to project site, ready for installation.

B. Install: Unpack, assemble, set in final position, fasten in place, make final connections, clean, adjust, and leave ready for use.

C. Provide: Furnish and install.

D. Receive: Accepting a delivery. (Entity responsible for accepting a delivery.)

E. Final Connections: Complete plumbing, mechanical, and electrical connections as required and recommended by manufacturer for optimum operation of equipment.

1.4 WORK COVERED BY CONTRACT DOCUMENTS

A. The Work of this Contract comprises the general construction (site and building) of a new 2-Bay Fire Station and its associated living quarters.

1. Project Location: W. Fayetteville Road, College Park GA 30337
2. Owner: City of College Park

1.5 WORK BY OWNER OR SEPARATE CONTRACTORS

A. Owner may award separate contracts for work at the Site, which will be executed concurrent with work of this Contract. Consult and cooperate with separate contractors to the full extent provided for in the Conditions of the Contract.

1.6 WORK SEQUENCE

A. The Work will be conducted in one single phase.
1.7 CONTRACTOR USE OF PREMISES

A. General: During the construction period the Contractor shall have full use of the premises for construction operations, including use of the site. The Contractor's use of the premises is limited only by the Owner's right to perform work or to retain other contractors on portions of the Project.

1.8 PRODUCTS ORDERED IN ADVANCE

A. General: This shall be done solely by the General Contractor unless otherwise instructed by the owner.

PART 2 - PRODUCTS (Not Applicable)

PART 3 – EXECUTION (Not Applicable)

END OF SECTION
PART 1 - GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

A. This Section includes administrative and supervisory requirements necessary for coordinating construction operations including, but not necessarily limited to, the following:

1. General project coordination procedures.
2. Conservation.
3. Coordination Drawings.
4. Administrative and supervisory personnel.
5. Cleaning and protection.

B. Related Sections: The following Sections contain requirements that relate to this Section:

1. Division 1 Section "Project Meetings" for progress meetings, coordination meetings, and pre-installation conferences.
2. Division 1 Section "Submittals" for preparing and submitting the Contractor's Construction Schedule.
3. Division 1 Section "Project Closeout" for coordinating contract closeout.

1.03 COORDINATION

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

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

B. Where necessary, prepare memoranda for distribution to each party involved, outlining special procedures required for coordination. Include such items as required notices, reports, and attendance at meetings.
1. Prepare similar memoranda for the Owner and separate contractors where coordination of their work is required.

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

1. Preparation of schedules.
2. Installation and removal of temporary facilities.
3. Delivery and processing of submittals.
4. Progress meetings.
5. Project closeout activities.

D. Conservation: Coordinate construction operations to assure that operations are carried out with consideration given to conservation of energy, water, and materials.

1. Salvage materials and equipment involved in performance of, but not actually incorporated in, the Work.

1.04 SUBMITTALS

A. Coordination Drawings: Prepare coordination drawings where careful coordination is needed for installation of products and materials fabricated by separate entities. Prepare coordination drawings where limited space availability necessitates maximum utilization of space for efficient installation of different components.

1. Show the relationship of components shown on separate Shop Drawings.
2. Indicate required installation sequences.
3. Comply with requirements contained in Section "Submittals."

B. Staff Names: Within 15 days of commencement of construction operations, submit a list of the Contractor's principal staff assignments, including the superintendent and other personnel in attendance at the Project Site. Identify individuals and their duties and responsibilities. List their addresses and telephone numbers.

1. Post copies of the list in the Project meeting room, the temporary field office, and each temporary telephone.

PART 2 - PRODUCTS (Not Applicable)

PART 3 - EXECUTION

3.01 GENERAL COORDINATION PROVISIONS
A. Inspection of Conditions: Require the Installer of each major component to inspect both the substrate and conditions under which Work is to be performed. Do not proceed until unsatisfactory conditions have been corrected in an acceptable manner.

B. Coordinate temporary enclosures with required inspections and tests to minimize the necessity of uncovering completed construction for that purpose.

3.02 CLEANING AND PROTECTION

A. Clean and protect construction in progress and adjoining materials in place, during handling and installation. Apply protective covering where required to assure protection from damage or deterioration at Substantial Completion.

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

C. Limiting Exposures: Supervise construction operations to assure that no part of the construction, completed or in progress, is subject to harmful, dangerous, damaging, or otherwise deleterious exposure during the construction period. Where applicable, such exposures include, but are not limited to, the following:

1. Excessive static or dynamic loading.
2. Excessive internal or external pressures.
3. Excessively high or low temperatures.
4. Thermal shock.
5. Excessively high or low humidity.
6. Air contamination or pollution.
7. Water or ice.
8. Solvents.
10. Light.
11. Radiation.
12. Puncture.
13. Abrasion.
14. Heavy traffic.
15. Soiling, staining, and corrosion.
16. Bacteria.
17. Rodent and insect infestation.
19. Electrical current.
20. High-speed operation.
21. Improper lubrication.
22. Unusual wear or other misuse.
23. Contact between incompatible materials.
24. Destructive testing.
25. Misalignment.
26. Excessive weathering.
27. Unprotected storage.
28. Improper shipping or handling.
29. Theft.
30. Vandalism.

END OF SECTION
PART 1 - GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

A. This Section specifies administrative and procedural requirements governing the Contractor's Applications for Payment.

B. This Section specifies administrative and procedural requirements governing each prime contractor's Applications for Payment.

1. Coordinate the Schedule of Values and Applications for Payment with the Contractor's Construction Schedule, Submittal Schedule, and List of Subcontracts.

C. Related Sections: The following Sections contain requirements that relate to this Section.

1. Schedules: The Contractor's Construction Schedule and Submittal Schedule are specified in Division 1 Section "Submittals."

1.03 SCHEDULE OF VALUES

A. Coordination: Each prime Contractor shall coordinate preparation of its Schedule of Values for its part of the Work with preparation of the Contractors' Construction Schedule.

1. Correlate line items in the Schedule of Values with other required administrative schedules and forms, including:

a. Contractor's Construction Schedule.
b. Application for Payment forms, including Continuation Sheets.
c. List of subcontractors.
d. Schedule of allowances.
e. Schedule of alternates.
f. List of products.
g. List of principal suppliers and fabricators.
h. Schedule of submittals.
2. Submit the Schedule of Values to the Architect at the earliest possible date but no later than 7 days before the date scheduled for submittal of the initial Applications for Payment.

3. Subschedules: Where Work is separated into phases requiring separately phased payments, provide subschedules showing values correlated with each phase of payment.

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

1. Identification: Include the following Project identification on the Schedule of Values:
   a. Project name and location.
   b. Name of the Architect.
   c. Project number.
   d. Contractor's name and address.
   e. Date of submittal.

2. Arrange the Schedule of Values in tabular form with separate columns to indicate the following for each item listed:
   a. Related Specification Section or Division.
   b. Description of Work.
   c. Name of subcontractor.
   d. Name of manufacturer or fabricator.
   e. Name of supplier.
   f. Change Orders (numbers) that affect value.
   g. Dollar value.

   1) Percentage of Contract Sum to nearest one-hundredth percent, adjusted to total 100 percent.

3. Provide a breakdown of the Contract Sum in sufficient detail to facilitate continued evaluation of Applications for Payment and progress reports. Coordinate with the Project Manual table of contents. Break principal subcontract amounts down into several line items.

4. Round amounts to nearest whole dollar; the total shall equal the Contract Sum.

5. Provide a separate line item in the Schedule of Values for each part of the Work where Applications for Payment may include materials or equipment, purchased or fabricated and stored, but not yet installed.
   a. Differentiate between items stored on-site and items stored off-site. Include requirements for insurance and bonded warehousing, if required.

6. Provide separate line items on the Schedule of Values for initial cost of the materials, for each subsequent stage of completion, and for total installed value of
that part of the Work.

7. Unit-Cost Allowances: Show the line-item value of unit-cost allowances, as a product of the unit cost, multiplied by the measured quantity. Estimate quantities from the best indication in the Contract Documents.

8. Margins of Cost: Show line items for indirect costs and margins on actual costs only when such items are listed individually in Applications for Payment. Each item in the Schedule of Values and Applications for Payment shall be complete. Include the total cost and proportionate share of general overhead and profit margin for each item.

a. Temporary facilities and other major cost items that are not direct cost of actual work-in-place may be shown either as separate line items in the Schedule of Values or distributed as general overhead expense, at the Contractor's option.

9. Schedule Updating: Update and resubmit the Schedule of Values prior to the next Applications for Payment when Change Orders or Construction Change Directives result in a change in the Contract Sum.

1.04 APPLICATIONS FOR PAYMENT

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

1. The initial Application for Payment, the Application for Payment at time of Substantial Completion, and the final Application for Payment involve additional requirements.

B. Payment-Application Times: Each progress-payment date is indicated in the Agreement. The period of construction Work covered by each Application for Payment is the period indicated in the Agreement.

C. Payment-Application Forms: Use AIA Document G702 and Continuation Sheets G703 as the form for Applications for Payment.

D. Application Preparation: Complete every entry on the form. Include notarization and execution by a person authorized to sign legal documents on behalf of the Contractor. The Architect will return incomplete applications without action.

1. Entries shall match data on the Schedule of Values and the Contractor's Construction Schedule. Use updated schedules if revisions were made.

2. Include amounts of Change Orders and Construction Change Directives issued prior to the last day of the construction period covered by the application.

E. Transmittal: Submit 3 signed and notarized original copies of each Application for Payment to the Architect by a method ensuring receipt within 24 hours. One copy
shall be complete, including waivers of lien and similar attachments, when required.

1. Transmit each copy with a transmittal form listing attachments and recording appropriate information related to the application, in a manner acceptable to the Architect.

F. Waivers of Mechanics Lien: With each Application for Payment, submit waivers of mechanics lien from every entity who is lawfully entitled to file a mechanics lien arising out of the Contract and related to the Work covered by the payment.

1. Submit partial waivers on each item for the amount requested, prior to deduction for retainage, on each item.
2. When an application shows completion of an item, submit final or full waivers.
3. The Owner reserves the right to designate which entities involved in the Work must submit waivers.
4. Waiver Delays: Submit each Application for Payment with the Contractor's waiver of mechanics lien for the period of construction covered by the application.
   a. Submit final Applications for Payment with or preceded by final waivers from every entity involved with performance of the Work covered by the application who is lawfully entitled to a lien.

5. Waiver Forms: Submit waivers of lien on forms, and executed in a manner, acceptable to the Owner.

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

1. List of subcontractors.
2. List of principal suppliers and fabricators.
3. Schedule of Values.
4. Contractor's Construction Schedule (preliminary if not final).
5. Schedule of principal products.
6. Schedule of unit prices.
7. Submittal Schedule (preliminary if not final).
8. List of Contractor's staff assignments.
12. Initial progress report.
14. Certificates of insurance and insurance policies.
15. Performance and payment bonds.
16. Data needed to acquire the Owner's insurance.
17. Initial settlement survey and damage report, if required.

H. Application for Payment at Substantial Completion: Following issuance of the Certificate of Substantial Completion, submit an Application for Payment.

1. This application shall reflect Certificates of Partial Substantial Completion issued previously for Owner occupancy of designated portions of the Work.
2. Administrative actions and submittals that shall precede or coincide with this application include:
   a. Occupancy permits and similar approvals.
   b. Warranties (guarantees) and maintenance agreements.
   c. Maintenance instructions.
   d. Startup performance reports.
   e. Changeover information related to Owner's occupancy, use, operation, and maintenance.
   f. Final cleaning.
   g. Application for reduction of retainage and consent of surety.
   h. Advice on shifting insurance coverages.
   i. Final progress photographs.
   j. List of incomplete Work, recognized as exceptions to Architect's Certificate of Substantial Completion.

I. Final Payment Application: Administrative actions and submittals that must precede or coincide with submittal of the final Application for Payment include the following:

1. Completion of Project closeout requirements.
2. Completion of items specified for completion after Substantial Completion.
3. Ensure that unsettled claims will be settled.
4. Ensure that incomplete Work is not accepted and will be completed without undue delay.
5. Transmittal of required Project construction records to the Owner.
6. Proof that taxes, fees, and similar obligations were paid.
7. Removal of temporary facilities and services.
8. Removal of surplus materials, rubbish, and similar elements.
9. Change of door locks to Owner's access.

PART 2 - PRODUCTS (Not Applicable)

PART 3 - EXECUTION (Not Applicable)

END OF SECTION
PART 1 - GENERAL

1.1 DESCRIPTION
A. Work included: To enable orderly review during progress of the Work, and to provide systematic discussion of problems, the Owner will conduct project meetings throughout the construction period.

1.2 QUALITY ASSURANCE
A. For those persons designated by the Contractor to attend and participate in project meetings, provide required authority to commit the Contractor to solutions agreed upon in the project meetings.

1.3 SUBMITTALS
A. Agenda Items: To the maximum extent practicable, advise the Owner at least twenty-four (24) hours in advance of project meetings regarding items to be added to the agenda.
B. Minutes:
1. The Contractor will compile minutes of each project meeting, send to Architect for review and comments prior to distribution, correct minutes per comments, if any, and then will distribute a copy to all meeting attendees and others involved in the project.
2. Recipients of copies may make and distribute such other copies as they wish.

PART 2 - PRODUCTS

(No products are required in this Section)

PART 3 - EXECUTION

3.1 MEETING SCHEDULE
A. Except as noted below for Preconstruction Meeting, Project meetings will be held not less than every other week and may be held weekly if deemed necessary by the Owner.
B. Coordinate as necessary to establish mutually acceptable schedule for meetings.

3.2 MEETING LOCATION
A. The Owner will establish meeting location. To the maximum extent practical, meetings will be held at the job site.

3.3 PRECONSTRUCTION MEETING
A. Preconstruction Meeting will be scheduled to be held not later than ten (10) working days after the Owner has issued the Notice to Proceed.
1. Provide attendance by authorized representatives of the Contractor and major subcontractors.
2. The Owner will advise other interested parties, including the Architect, and invite their attendance.
B. Minimum agenda: Data will be distributed and discussed on at least the following items.
   1. Organizational arrangement of Contractor's forces and personnel, and those of subcontractors, material suppliers and Architect;
   2. Channels and procedures for communications;
   3. Construction schedule, including sequence of critical work;
   4. Contract documents, including distribution of required copies of original documents and revisions;
   5. Processing of Shop Drawings and other data submitted to the Architect for review;
   6. Rules and regulations governing performance of Work;

3.4 PROJECT MEETINGS

A. Attendance:
   1. To the maximum extent practicable, assign the same person or persons to represent the Contractor at project meetings throughout progress of the Work.
   2. Subcontractors, material suppliers, and others may be invited to attend those project meetings in which their aspect of the Work is involved.

B. Minimum Agenda:
   1. Review, revise as necessary and approve minutes of previous meetings;
   2. Review progress of the Work since last meeting, including status of submittals for approval;
   3. Identify problems which impede planned progress;
   4. Develop corrective measures and procedures to regain planned schedule;
   5. Complete other current business.

C. Revisions to minutes:
   1. Unless published minutes are challenged in writing prior to the next regularly scheduled progress meeting, they will be accepted as properly stating the activities and decisions of the meeting.
   2. Persons challenging published minutes shall reproduce and distribute copies of the challenge to all indicated recipients of the particular set of minutes.
   3. Challenge to minutes shall be settled as priority portion of "old business" at the next regularly scheduled meeting.

END OF SECTION
PART 1 - GENERAL

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

1.2 SUMMARY
A. This Section includes administrative and procedural requirements for submittals required for performance of the Work, including the following:

1. Contractor's construction schedule.
2. Submittal schedule.
3. Daily construction reports.
4. Shop Drawings.
5. Product Data.
6. Samples.
7. Quality assurance submittals.

B. Administrative Submittals: Refer to other Division 1 Sections and other Contract Documents for requirements for administrative submittals. Such submittals include, but are not limited to, the following:

1. Permits.
2. Applications for Payment.
3. Performance and payment bonds.
4. Insurance certificates.
5. List of subcontractors.

C. Related Sections: The following Sections contain requirements that relate to this Section:

1. Division 1 Section "Applications for Payment" specifies requirements for submittal of the Schedule of Values.
2. Division 1 Section "Coordination" specifies requirements governing preparation and submittal of required Coordination Drawings.
3. Division 1 Section "Project Meetings" specifies requirements for submittal and distribution of meeting and conference minutes.
4. Division 1 Section "Quality Control" specifies requirements for submittal of inspection and test reports.
5. Division 1 Section "Project Closeout" specifies requirements for submittal of Project Record Documents and warranties at project closeout.

1.3 DEFINITIONS
A. Coordination Drawings show the relationship and integration of different construction elements that require careful coordination during fabrication or installation to fit in the space provided or to function as intended.
1. Preparation of Coordination Drawings is specified in Division 1 Section "Coordination" and may include components previously shown in detail on Shop Drawings or Product Data.

B. Field samples are full-size physical examples erected on-site to illustrate finishes, coatings, or finish materials. Field samples are used to establish the standard by which the Work will be judged.

C. Mockups are full-size assemblies for review of construction, coordination, testing, or operation; they are not Samples.

1.4 SUBMITTAL PROCEDURES

A. Coordination: Coordinate preparation and processing of submittals with performance of construction activities. Transmit each submittal sufficiently in advance of performance of related construction activities to avoid delay.

1. Coordinate each submittal with fabrication, purchasing, testing, delivery, other submittals, and related activities that require sequential activity.

2. Coordinate transmittal of different types of submittals for related elements of the Work so processing will not be delayed by the need to review submittals concurrently for coordination.

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

3. Processing: To avoid the need to delay installation as a result of the time required to process submittals, allow sufficient time for submittal review, including time for resubmittals.

   a. Allow 2 weeks for initial review. Allow additional time if the Architect must delay processing to permit coordination with subsequent submittals.

   b. If an intermediate submittal is necessary, process the same as the initial submittal.

   c. Allow 2 weeks for reprocessing each submittal.

   d. No extension of Contract Time will be authorized because of failure to transmit submittals to the Architect sufficiently in advance of the Work to permit processing.

B. Submittal Preparation: Place a permanent label or title block on each submittal for identification. Indicate the name of the entity that prepared each submittal on the label or title block.

1. Provide a space approximately 4 by 5 inches (100 by 125 mm) on the label or beside the title block on Shop Drawings to record the Contractor's review and approval markings and the action taken.

2. Include the following information on the label for processing and recording action taken.

   a. Project name.
   b. Date.
c. Name and address of the Architect.
d. Name and address of the Contractor.
e. Name and address of the subcontractor.
f. Name and address of the supplier.
g. Name of the manufacturer.
h. Number and title of appropriate Specification Section.
i. Drawing number and detail references, as appropriate.

C. Submittal Transmittal: Package each submittal appropriately for transmittal and handling. Transmit each submittal from the Contractor to the Architect using a transmittal form. The Architect will not accept submittals received from sources other than the Contractor. Electronic submittal will be acceptable in PDF format with the exception of SAMPLES. However, the submittal shall follow the procedures indicated above and below.

1. On the transmittal, record relevant information and requests for data. On the form, or separate sheet, record deviations from Contract Document requirements, including variations and limitations. Include Contractor's certification that information complies with Contract Document requirements.


1.5 CONTRACTOR'S CONSTRUCTION SCHEDULE

A. Bar-Chart Schedule: Prepare a fully developed, horizontal bar-chart-type, contractor's construction schedule. Submit within 30 days after the date established for "Commencement of the Work."

1. Provide a separate time bar for each significant construction activity. Provide a continuous vertical line to identify the first working day of each week. Use the same breakdown of units of the Work as indicated in the "Schedule of Values."

2. Within each time bar, indicate estimated completion percentage in 10 percent increments. As Work progresses, place a contrasting mark in each bar to indicate Actual Completion.

3. Prepare the schedule on a sheet, or series of sheets, of stable transparency, or other reproducible media, of sufficient width to show data for the entire construction period.

4. Secure time commitments for performing critical elements of the Work from parties involved. Coordinate each element on the schedule with other construction activities; include minor elements involved in the sequence of the Work. Show each activity in proper sequence. Indicate graphically the sequences necessary for completion of related portions of the Work.

5. Coordinate the Contractor's Construction Schedule with the Schedule of Values, list of subcontracts, Submittal Schedule, progress reports, payment requests, and other schedules.

6. Indicate completion in advance of the date established for Substantial Completion. Indicate Substantial Completion on the schedule to allow time for the Architect's procedures necessary for certification of Substantial Completion.

B. Phasing: On the schedule, show how requirements for phased completion to permit Work by separate Contractors and partial occupancy by the Owner affect the sequence of Work.
C. Work Stages: Indicate important stages of construction for each major portion of the Work, including submittal review, testing, and installation.

D. Area Separations: Provide a separate time bar to identify each major construction area for each major portion of the Work. Indicate where each element in an area must be sequenced or integrated with other activities.

E. Cost Correlation: At the head of the schedule, provide a cost correlation line, indicating planned and actual costs. On the line, show dollar volume of Work performed as of the dates used for preparation of payment requests.

1. Refer to Division 1 Section "Applications for Payment" for cost reporting and payment procedures.

F. Distribution: Following response to the initial submittal, print and distribute copies to the Architect, Owner, subcontractors, and other parties required to comply with scheduled dates. Post copies in the Project meeting room and temporary field office.

1. When revisions are made, distribute to the same parties and post in the same locations. Delete parties from distribution when they have completed their assigned portion of the Work and are no longer involved in construction activities.

G. Schedule Updating: Revise the schedule after each meeting, event, or activity where revisions have been recognized or made. Issue the updated schedule concurrently with the report of each meeting.

1.6 SUBMITTAL SCHEDULE

A. After development and acceptance of the Contractor's Construction Schedule, prepare a complete schedule of submittals. Submit the schedule within 10 days of the date required for submittal of the Contractor's Construction Schedule.

1. Coordinate Submittal Schedule with the list of subcontracts, Schedule of Values, and the list of products as well as the Contractor's Construction Schedule.
2. Prepare the schedule in chronological order. Provide the following information:
   
   a. Scheduled date for the first submittal.
   b. Related Section number.
   c. Submittal category (Shop Drawings, Product Data, or Samples).
   d. Name of the subcontractor.
   e. Description of the part of the Work covered.
   f. Scheduled date for resubmittal.
   g. Scheduled date for the Architect's final release or approval.

B. Distribution: Following response to the initial submittal, print and distribute copies to the Architect, Owner, subcontractors, and other parties required to comply with submittal dates indicated. Post copies in the Project meeting room and field office.

1. When revisions are made, distribute to the same parties and post in the same locations. Delete parties from distribution when they have completed their assigned portion of the Work and are no longer involved in construction activities.
C. Schedule Updating: Revise the schedule after each meeting or activity where revisions have been recognized or made. Issue the updated schedule concurrently with the report of each meeting.

1.7 DAILY CONSTRUCTION REPORTS

A. Prepare a daily construction report recording the following information concerning events at the site, and submit duplicate copies to the Architect at weekly intervals:

1. List of subcontractors at the site.
2. Approximate count of personnel at the site.
3. High and low temperatures, general weather conditions.
4. Accidents and unusual events.
5. Meetings and significant decisions.
7. Meter readings and similar recordings.
8. Emergency procedures.
9. Orders and requests of governing authorities.
10. Change Orders received, implemented.
11. Services connected, disconnected.
12. Equipment or system tests and startups.
13. Partial Completions, occupancies.

1.8 SHOP DRAWINGS

A. Submit newly prepared information drawn accurately to scale. Highlight, encircle, or otherwise indicate deviations from the Contract Documents. Do not reproduce Contract Documents or copy standard information as the basis of Shop Drawings. Standard information prepared without specific reference to the Project is not a Shop Drawing.

B. Shop Drawings include fabrication and installation Drawings, setting diagrams, schedules, patterns, templates and similar Drawings. Include the following information:

1. Dimensions.
2. Identification of products and materials included by sheet and detail number.
3. Compliance with specified standards.
4. Notation of coordination requirements.
5. Notation of dimensions established by field measurement.
6. Sheet Size: Except for templates, patterns and similar full-size Drawings, submit Shop Drawings on sheets at least 8-1/2 by 11 inches (215 by 280 mm) but no larger than 36 by 48 inches (890 by 1220 mm).
7. Initial Submittal: Submit 2 blue- or black-line prints for the Architect's review. The Architect will return one print.
8. Final Submittal: Submit 3 blue- or black-line prints; submit 5 prints where required for maintenance manuals. The Architect will retain 2 prints and return the remainder.
9. Do not use Shop Drawings without an appropriate final stamp indicating action taken.

1.9 PRODUCT DATA
A. Collect Product Data into a single submittal for each element of construction or system. Product Data includes printed information, such as manufacturer's installation instructions, catalog cuts, standard color charts, roughing-in diagrams and templates, standard wiring diagrams, and performance curves.

1. Mark each copy to show applicable choices and options. Where printed Product Data includes information on several products that are not required, mark copies to indicate the applicable information. Include the following information:
   a. Manufacturer's printed recommendations.
   b. Compliance with trade association standards.
   c. Compliance with recognized testing agency standards.
   d. Application of testing agency labels and seals.
   e. Notation of dimensions verified by field measurement.
   f. Notation of coordination requirements.

2. Do not submit Product Data until compliance with requirements of the Contract Documents has been confirmed.

3. Preliminary Submittal: Submit a preliminary single copy of Product Data where selection of options is required.

4. Submittals: Submit 5 copies of each required submittal; submit 4 copies where required for maintenance manuals. The Architect will retain one and will return the other marked with action taken and corrections or modifications required.
   a. Unless noncompliance with Contract Document provisions is observed, the submittal may serve as the final submittal.

5. Distribution: Furnish copies of final submittal to installers, subcontractors, suppliers, manufacturers, fabricators, and others required for performance of construction activities. Show distribution on transmittal forms.
   a. Do not proceed with installation until a copy of Product Data is in the Installer's possession.
   b. Do not permit use of unmarked copies of Product Data in connection with construction.

1.10 SAMPLES

A. Submit full-size, fully fabricated Samples cured and finished as specified and physically identical with the material or product proposed. Samples include partial sections of manufactured or fabricated components, cuts or containers of materials, color range sets, and swatches showing color, texture, and pattern.

1. Mount or display Samples in the manner to facilitate review of qualities indicated. Prepare Samples to match the Architect's sample. Include the following:
   a. Specification Section number and reference.
   b. Generic description of the Sample.
   c. Sample source.
   d. Product name or name of the manufacturer.
   e. Compliance with recognized standards.
2. Submit Samples for review of size, kind, color, pattern, and texture. Submit Samples for a final check of these characteristics with other elements and a comparison of these characteristics between the final submittal and the actual component as delivered and installed.

   a. Where variation in color, pattern, texture, or other characteristic is inherent in the material or product represented, submit at least 3 multiple units that show approximate limits of the variations.

   b. Refer to other Specification Sections for requirements for Samples that illustrate workmanship, fabrication techniques, details of assembly, connections, operation, and similar construction characteristics.

   c. Refer to other Sections for Samples to be returned to the Contractor for incorporation in the Work. Such Samples must be undamaged at time of use. On the transmittal, indicate special requests regarding disposition of Sample submittals.

   d. Samples not incorporated into the Work, or otherwise designated as the Owner's property, are the property of the Contractor and shall be removed from the site prior to Substantial Completion.

3. Preliminary Submittals: Submit a full set of choices where Samples are submitted for selection of color, pattern, texture, or similar characteristics from a range of standard choices.

   a. The Architect will review and return preliminary submittals with the Architect's notation, indicating selection and other action.

4. Submittals: Except for Samples illustrating assembly details, workmanship, fabrication techniques, connections, operation, and similar characteristics, submit 5 sets. The Architect will return 2 sets marked with the action taken.

5. Maintain sets of Samples, as returned, at the Project Site, for quality comparisons throughout the course of construction.

   a. Unless noncompliance with Contract Document provisions is observed, the submittal may serve as the final submittal.

   b. Sample sets may be used to obtain final acceptance of the construction associated with each set.

B. Distribution of Samples: Prepare and distribute additional sets to subcontractors, manufacturers, fabricators, suppliers, installers, and others as required for performance of the Work. Show distribution on transmittal forms.

1. Field samples are full-size examples erected on-site to illustrate finishes, coatings, or finish materials and to establish the Project standard.

   a. Comply with submittal requirements to the fullest extent possible. Process transmittal forms to provide a record of activity.

1.11 QUALITY ASSURANCE SUBMITTALS
A. Submit quality-control submittals, including design data, certifications, manufacturer's instructions, manufacturer's field reports, and other quality-control submittals as required under other Sections of the Specifications, or on Drawings if not in Master Specification book.

B. Certifications: Where other Sections of the Specifications require certification that a product, material, or installation complies with specified requirements, submit a notarized certification from the manufacturer certifying compliance with specified requirements.

1. Signature: Certification shall be signed by an officer of the manufacturer or other individual authorized to sign documents on behalf of the company.

C. Inspection and Test Reports: Requirements for submittal of inspection and test reports from independent testing agencies are specified in Division 1 Section "Quality Control."

1.12 ARCHITECT’S ACTION

A. Except for submittals for the record or information, where action and return is required, the Architect will review each submittal, mark to indicate action taken, and return promptly.

1. Compliance with specified characteristics is the Contractor's responsibility.

B. Action Stamp: The Architect will stamp each submittal with a uniform, action stamp. The Architect will mark the stamp appropriately to indicate the action taken, as follows:

1. Final Unrestricted Release: When the Architect marks a submittal "No Exceptions Taken," the Work covered by the submittal may proceed provided it complies with requirements of the Contract Documents. Final payment depends on that compliance.

2. Final-But-Restricted Release: When the Architect marks a submittal "Exceptions as Noted," the Work covered by the submittal may proceed provided it complies with notations or corrections on the submittal and requirements of the Contract Documents. Final payment depends on that compliance.

3. Returned for Resubmittal: When the Architect marks a submittal "Revise and Resubmit," do not proceed with Work covered by the submittal, including purchasing, fabrication, delivery, or other activity. Revise or prepare a new submittal according to the notations; resubmit without delay. Repeat if necessary to obtain different action mark.

   a. Do not use, or allow others to use, submittals marked "Revise and Resubmit" at the Project Site or elsewhere where Work is in progress.

4. Not Approved: When the Architect marks a submittal "Rejected" do not proceed with Work covered by the submittal, including purchasing, fabrication, delivery, or other activity. Prepare a new submittal.

   a. Do not use, or allow others to use, submittals marked "Rejected" at the Project Site or elsewhere where Work is in progress.

5. Supplementary Submittal: When the Architect marks a submittal "Submit Specified Item" submit the exact item as indicated in Contract Documents.
GENERAL REQUIREMENTS

SUBMITTALS
DIVISION 1
SECTION 01330

6. Other Action: Where a submittal is for information or record purposes or special processing or other activity, the Architect will return the submittal to sender without action.

C. Unsolicited Submittals: The Architect will discard unsolicited submittals without action and notify sender in writing (including email) that submittal was unsolicited.

PART 2 - PRODUCTS (Not Applicable)

PART 3 - EXECUTION (Not Applicable)

END OF SECTION
PART 1 - GENERAL

1.1 SECTION REQUIREMENTS

A. Testing and inspecting services are required to verify compliance with requirements specified or indicated. These services do not relieve Contractor of responsibility for compliance with the Contract Document requirements.
   1. Contractor shall provide, at his expense, all testing and inspecting services.
   2. Contractor is responsible for scheduling inspections and tests and notifying testing agency.
   3. Retesting and Reinspecting: Contractor shall pay for additional testing and inspecting required as a result of tests and inspections indicating noncompliance with requirements.

B. Performance and Design Criteria: Where design services or certifications by a professional engineer are required by the Contract Documents, provide products and systems complying with specific performance and design criteria indicated.
   1. If criteria indicated are not sufficient to perform services or certification required, submit a written request for additional information to Architect.
   2. Professional Engineer Qualifications: A professional engineer who is legally qualified to practice in jurisdiction where Project is located and who is experienced in providing engineering services of the kind indicated.

C. Submittals: Testing agency shall submit a certified written report of each inspection and test to Owner, Architect, Contractor, structural engineer, and to authorities having jurisdiction when authorities so direct. Reports of each inspection, test, or similar service shall include the following:
   1. Name, address, and telephone number of testing agency.
   2. Project title and testing agency's project number.
   3. Date of report and designation (number).
   4. Dates and locations where samples were taken or inspections and field tests made.
   5. Ambient conditions at the time of sample taking and inspecting or field testing.
   6. Names of individuals taking the sample or making the inspection or test.
   7. Product and test method.
   8. Inspection or test data including interpretation of test results and comments or professional opinion on whether inspected or tested Work complies with requirements.
   9. Recommendations on retesting or reinspection.
   10. Name and signature of laboratory inspector.

D. Testing Agency Qualifications: Agencies that specialize in the types of inspections and tests to be performed and are acceptable to authorities having jurisdiction.

E. Testing Agency Responsibilities: Testing agency shall cooperate with Architect and Contractor in performing its duties and shall provide qualified personnel to perform inspections and tests.
   1. Agency shall promptly notify Architect and Contractor of deficiencies in the Work observed during performance of its services.
   2. Agency shall not release, revoke, alter, or enlarge requirements of the Contract Documents nor approve or accept any portion of the Work.
   3. Agency shall not perform duties of Contractor.

F. Auxiliary Services: Cooperate with testing agencies and provide auxiliary services as requested, including the following:
   1. Access to the Work.
2. Incidental labor and facilities to assist inspections and tests.
3. Adequate quantities of materials for testing, and assistance in taking samples.
4. Facilities for storing and curing test samples.
5. Security and protection for samples and test equipment.

1.2 TESTING AND INSPECTION SERVICES

A. Testing and inspecting services are not limited to the items listed below. Contractor shall provide all testing and inspecting services specified below and in other Sections of these Specifications or the Drawings, or are required by authorities having jurisdiction and shall be performed by independent testing agencies. Contractor shall engage an independent testing agency service per the qualifications indicated above. Reports of these tests shall be documented and distributed in accordance with the above stated requirements.

B. The following tests and inspections are required:
   1. Division 2 Site Construction, Base: to conform to the recommendations of the soils report.
   2. Division 2 Site Construction, Hot-Mix Asphalctic Paving: to conform to the standards and materials as indicated on the drawings.
   3. Division 2 Site Construction, Portland Cement Paving: to conform to the standards and materials as indicated on the drawings.
   4. Abatement Clearance testing.

PART 2 - PRODUCTS (Not Applicable)

PART 3 - EXECUTION (Not Applicable)

END OF SECTION
PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This Section includes administrative and procedural requirements governing the Contractor's selection of Information Technology vendors for use in the Project.

1. Subcontractors Contracts: Provisions of this Section apply to the construction activities of each subcontractor.

1.3 SECTION REQUIREMENTS

A. Scheduling and Coordination for the installation of all information technology systems (including but not limited to low voltage electrical for cable, telephone, data, fiber, SAN, security cameras, and speakers) shall be the responsibility of the Contractor.

1. Contractor shall provide all conduit and boxes for the Work.

B. Contractor shall engage Owners vendor(s) indicated in the below table to install the information technology systems.

1. Contact Owners IT Director: Tammy Hester, City of College Park, GA; Tel(404) 669-4604; email: thester@collegeparkga.com for specific Vendor contact information.

<table>
<thead>
<tr>
<th>Item</th>
<th>Vendor</th>
<th>Contact</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cisco Router/Switch</td>
<td>SPS (Adcap)</td>
<td></td>
</tr>
<tr>
<td>Cisco VoIP Phones / License</td>
<td>SPS (Adcap)</td>
<td></td>
</tr>
<tr>
<td>Computers</td>
<td>Dell</td>
<td></td>
</tr>
<tr>
<td>Fiber</td>
<td>Virtual Citadel</td>
<td>Michael Oken (<a href="mailto:moken@vcitadel.com">moken@vcitadel.com</a>)</td>
</tr>
<tr>
<td>Low voltage cabling</td>
<td>TenTech</td>
<td>Dan Tennant (<a href="mailto:dant@tentech.it">dant@tentech.it</a>)</td>
</tr>
<tr>
<td>POTS/FB1 backup phone lines</td>
<td>AT&amp;T</td>
<td></td>
</tr>
<tr>
<td>SAN</td>
<td>Dell</td>
<td></td>
</tr>
<tr>
<td>Security Cameras</td>
<td>Tyco</td>
<td></td>
</tr>
<tr>
<td>Televisions</td>
<td>Various</td>
<td></td>
</tr>
<tr>
<td>Wireless access points</td>
<td>TenTech / ISO</td>
<td></td>
</tr>
</tbody>
</table>

PART 2 - PRODUCTS

Not Used

PART 3 - EXECUTION
3.1 INSTALLATION OF PRODUCTS

A. Comply with manufacturer's instructions and recommendations for installation of products in the applications indicated. Anchor each product securely in place, accurately located and aligned with other Work.

1. Clean exposed surfaces and protect as necessary to ensure freedom from damage and deterioration at time of Substantial Completion.

END OF SECTION
PART 1 - GENERAL

1.1 DESCRIPTION

A. Work included: Provide temporary facilities and controls needed for the Work including, but not necessarily limited to:
   1. Temporary utilities such as heat, water, electricity and telephone;
   2. Field office for the Contractor’s personnel and area for meetings with Owner and Architect or Owner’s other Consultants;
   3. Sanitary facilities;
   4. Temporary barriers of the construction site;
   5. Project sign – Sign shall be approved and include the Owner and Architect’s information.

B. Related Work:
   1. Except that equipment furnished by Subcontractors shall comply with requirements of pertinent safety regulations, such equipment normally furnished by the individual trades in execution of their own portions of the Work are not part of this Section.

1.2 PRODUCT HANDLING

A. Maintain temporary facilities and controls in proper and safe conditions throughout progress of the Work.

PART 2 - PRODUCTS

2.1 UTILITIES

A. General: The Contractor shall provide water and electrical power utility service required by the Work.

B. Water:
   1. Provide necessary temporary piping and water supply and, upon completion of the Work, remove such temporary facilities.

C. Electricity:
   1. Provide necessary temporary wiring and, upon completion of the Work, remove such temporary facility.
   2. Provide area distribution boxes so located that the individual trades may furnish and use 100 ft. maximum length extension cords to obtain power and lighting at points where needed for Work, inspection and safety.

D. Telephone:
   1. Make necessary arrangements and pay costs for installation and operation of telephone service to the Contractor’s office at the site.
   2. Make the telephone available to the Architect and Owner for use in connection with the Work.

2.2 FIELD OFFICES AND SHEDS

A. Contractor’s facilities:
   1. Provide a field office building and sheds adequate in size and accommodation for Contractor’s offices, supply and storage.
2. Within the Contractor’s facilities, provide enclosed space adequate for holding project meetings. Furnish with table, chairs and utilities.

B. Sanitary facilities:
   1. Provide temporary sanitary facilities in the quality required for use by all personnel.
   2. Maintain in a sanitary condition at all times.

2.3 ENCLOSURES

A. Provide and maintain for the duration of construction all scaffolds, tarpaulins, canopies, warning signs, steps, platforms, bridges, and other temporary construction necessary for proper completion of the Work in compliance with pertinent safety and other regulations.

2.4 TEMPORARY BARRIERS

A. Provide and maintain for the duration of construction a temporary barrier as required, of design and type needed to prevent entry onto the Work by the public. Install and maintain thereon “Hazardous Area” signs sufficient to warn the public.

2.5 PROJECT SIGNS

A. Prior to start of construction, submit proposed Project sign layout to the Architect for approval.
   1. Furnish and install a minimum of one (1) Project Sign.
   2. Project sign shall include the name and logo of Architect and Owner.
   3. Mount Sign at job site where directed by Architect and Owner.
   4. Except as otherwise specifically approved by the Owner, do not permit other signs or advertising on the job site.
   5. Project sign shall be erected on site within 14 days of NTP.
   6. Project sign shall be no less than 4’ x 8’. Double sided.

B. Manufacturer:
   1. A+ Signs. Decatur, GA.
   2. FAST SIGNS, Smyrna, GA.
   3. FAST SIGNS, Tucker, GA.
   4. FruArt, Decatur, GA.
   5. Rapid Signs, Atlanta, GA.
   6. Other manufacturers who provide the specified sign type.

C. Materials:
   1. 96 in. x 48 in. x ¾ in. Plywood.
   2. Weather resistant Paint & vinyl coatings.
   3. 4 x 4 Wood Lumber. Provide other lumber as required by contractor’s design for sign support
   4. Fasteners

D. Execution:
   1. Embed wood lumber post in ground. Mount sing to posts. Brace with wood lumber as necessary.
   2. Install sign erect and plumb.
   3. Maintain sign installation throughout project duration.
   4. Remove sign when directed by Owner.

2.6 TRANSPORTATION FACILITIES
A. Truck and equipment access:
   1. To avoid traffic conflict with vehicles of the Owner’s employees, and to avoid overloading of
      streets and driveways elsewhere on the Owner’s property, limit the access of trucks and
      equipment to the ACCESS ROUTE as directed by the Architect.
   2. Provide adequate protection for curbs and sidewalks over which trucks and equipment pass
      to reach the job site.

B. Remove such temporary facilities and controls as rapidly as progress of the Work will
   permit, or as directed by the Architect.

PART 3 - EXECUTION

3.1 SECURITY

A. Restrict the access of all persons entering upon the Owner’s property in connection with the
   Work to the Access Route and to the actual site of the Work. The Contractor is responsible for
   providing adequate security to the building and its contents during the construction period.
   When school is in session and the Contractor is on the premises, the Owner and Contractor will
   be jointly responsible for security of the building. When the Contractor is on the premises after
   school hours and no owner’s representative is on the premises, the Contractor will be fully
   responsible for security.

END OF SECTION
GENERAL REQUIREMENTS PRODUCT REQUIREMENTS
DIVISION 1 SECTION 01600

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This Section includes administrative and procedural requirements governing the Contractor's selection of products for use in the Project.

1. Multiple Prime Contracts: Provisions of this Section apply to the construction activities of each prime contractor.

B. Related Sections: The following Sections contain requirements that relate to this Section:

1. Division 1 Section "Reference Standards and Definitions" specifies the applicability of industry standards to products specified.
2. Division 1 Section "Submittals" specifies requirements for submittal of the Contractor's Construction Schedule and the Submittal Schedule.
3. Division 1 Section "Substitutions" specifies administrative procedures for handling requests for substitutions made after award of the Contract.

1.3 DEFINITIONS

A. Definitions used in this Article are not intended to change the meaning of other terms used in the Contract Documents, such as "specialties," "systems," "structure," "finishes," "accessories," and similar terms. Such terms are self-explanatory and have well-recognized meanings in the construction industry.

1. "Products" are items purchased for incorporation in the Work, whether purchased for the Project or taken from previously purchased stock. The term "product" includes the terms "material," "equipment," "system," and terms of similar intent.

a. "Named Products" are items identified by the manufacturer's product name, including make or model number or other designation, shown or listed in the manufacturer's published product literature that is current as of the date of the Contract Documents.

b. "Foreign Products," as distinguished from "domestic products," are items substantially manufactured (50 percent or more of value) outside the United States and its possessions. Products produced or supplied by entities substantially owned (more than 50 percent) by persons who are not citizens of, nor living within, the United States and its possessions are also considered to be foreign products.

2. "Materials" are products substantially shaped, cut, worked, mixed, finished, refined or otherwise fabricated, processed, or installed to form a part of the Work.

3. "Equipment" is a product with operational parts, whether motorized or manually operated, that requires service connections, such as wiring or piping.

1.4 SUBMITTALS
A. Product List: Prepare a schedule in tabular form showing each product used in the project. Include the manufacturer's name and proprietary product names for each item listed.

B. Product List: Prepare a list showing products specified in tabular form acceptable to the Architect. Include generic names of products required. Include the manufacturer's name and proprietary product names for each item listed.

1. Coordinate product list with the Contractor's Construction Schedule and the Schedule of Submittals.
2. Form: Prepare product list with information on each item tabulated under the following column headings:
   a. Related Specification Section number.
   b. Generic name used in Contract Documents.
   c. Proprietary name, model number, and similar designations.
   d. Manufacturer's name and address.
   e. Supplier's name and address.
   f. Installer's name and address.
   g. Projected delivery date or time span of delivery period.

3. Initial Submittal: Within 30 days after date of commencement of the Work, submit 3 copies of an initial product list. Provide a written explanation for omissions of data and for known variations from Contract requirements.

   a. At the Contractor's option, the initial submittal may be limited to product selections and designations that must be established early in the Contract period.

4. Completed List: Within 60 days after date of commencement of the Work, submit 3 copies of the completed product list. Provide a written explanation for omissions of data and for known variations from Contract requirements.

5. Architect's Action: The Architect will respond in writing to Contractor within 2 weeks of receipt of the completed product list. No response within this period constitutes no objection to listed manufacturers or products but does not constitute a waiver of the requirement that products comply with Contract Documents. The Architect's response will include a list of unacceptable product selections, containing a brief explanation of reasons for this action.

1.5 QUALITY ASSURANCE

A. Source Limitations: To the fullest extent possible, provide products of the same kind from a single source.

   1. When specified products are available only from sources that do not, or cannot, produce a quantity adequate to complete project requirements in a timely manner, consult with the Architect to determine the most important product qualities before proceeding. Qualities may include attributes, such as visual appearance, strength, durability, or compatibility. When a determination has been made, select products from sources producing products that possess these qualities, to the fullest extent possible.
B. Compatibility of Options: When the Contractor is given the option of selecting between 2 or more products for use on the Project, the product selected shall be compatible with products previously selected, even if previously selected products were also options.

1. Each prime contractor is responsible for providing products and construction methods that are compatible with products and construction methods of other prime or separate contractors.
2. If a dispute arises between prime contractors over concurrently selectable, but incompatible products, the Architect will determine which products shall be retained and which are incompatible and must be replaced.

C. Foreign Product Limitations: Except under one or more of the following conditions, provide domestic products, not foreign products, for inclusion in the Work:

1. No available domestic product complies with the Contract Documents.
2. Domestic products that comply with the Contract Documents are available only at prices or terms substantially higher than foreign products that comply with the Contract Documents.

D. Nameplates: Except for required labels and operating data, do not attach or imprint manufacturer's or producer's nameplates or trademarks on exposed surfaces of products that will be exposed to view in occupied spaces or on the exterior.

1. Labels: Locate required product labels and stamps on concealed surfaces or, where required for observation after installation, on accessible surfaces that are not conspicuous.
2. Equipment Nameplates: Provide a permanent nameplate on each item of service-connected or power-operated equipment. Locate on an easily accessible surface that is inconspicuous in occupied spaces. The nameplate shall contain the following information and other essential operating data:
   a. Name of product and manufacturer.
   b. Model and serial number.
   c. Capacity.
   d. Speed.
   e. Ratings.

1.6 PRODUCT DELIVERY, STORAGE, AND HANDLING

A. Deliver, store, and handle products according to the manufacturer's recommendations, using means and methods that will prevent damage, deterioration, and loss, including theft.

1. Schedule delivery to minimize long-term storage at the site and to prevent overcrowding of construction spaces.
2. Coordinate delivery with installation time to assure minimum holding time for items that are flammable, hazardous, easily damaged, or sensitive to deterioration, theft, and other losses.
3. Deliver products to the site in an undamaged condition in the manufacturer's original sealed container or other packaging system, complete with labels and instructions for handling, storing, unpacking, protecting, and installing.
4. Inspect products upon delivery to ensure compliance with the Contract Documents and to ensure that products are undamaged and properly protected.
5. Store products at the site in a manner that will facilitate inspection and measurement of quantity or counting of units.

01600-3
6. Store heavy materials away from the Project structure in a manner that will not endanger the supporting construction.
7. Store products subject to damage by the elements above ground, under cover in a weathertight enclosure, with ventilation adequate to prevent condensation. Maintain temperature and humidity within range required by manufacturer's instructions.

PART 2 - PRODUCTS

2.1 PRODUCT SELECTION

A. General Product Requirements: Provide products that comply with the Contract Documents, that are undamaged and, unless otherwise indicated, new at the time of installation.
   1. Provide products complete with accessories, trim, finish, safety guards, and other devices and details needed for a complete installation and the intended use and effect.
   2. Standard Products: Where available, provide standard products of types that have been produced and used successfully in similar situations on other projects.

B. Product Selection Procedures: The Contract Documents and governing regulations govern product selection. Procedures governing product selection include the following:
   1. Proprietary Specification Requirements: Where Specifications name only a single product or manufacturer, provide the product indicated. “Note that if a brand name is used an approved equal may be substituted. Instructions for “Requests for Substitutions” may be found in the General Conditions section. Substitutions must be approved by the County prior to award by the Board of Commissioners.”
   2. Semi-proprietary Specification Requirements: Where Specifications name 2 or more products or manufacturers, provide 1 of the products indicated. No substitutions will be permitted.
      a. Where Specifications specify products or manufacturers by name, accompanied by the term "or equal" or "or approved equal," comply with the Contract Document provisions concerning "substitutions" to obtain approval for use of an unnamed product.
   3. Nonproprietary Specifications: When Specifications list products or manufacturers that are available and may be incorporated in the Work, but do not restrict the Contractor to use of these products only, the Contractor may propose any available product that complies with Contract requirements. Comply with Contract Document provisions concerning "substitutions" to obtain approval for use of an unnamed product.
   4. Descriptive Specification Requirements: Where Specifications describe a product or assembly, listing exact characteristics required, with or without use of a brand or trade name, provide a product or assembly that provides the characteristics and otherwise complies with Contract requirements.
   5. Performance Specification Requirements: Where Specifications require compliance with performance requirements, provide products that comply with these requirements and are recommended by the manufacturer for the application indicated.
      a. Manufacturer's recommendations may be contained in published product literature or by the manufacturer's certification of performance.
6. Compliance with Standards, Codes, and Regulations: Where Specifications only require compliance with an imposed code, standard, or regulation, select a product that complies with the standards, codes, or regulations specified.

7. Visual Matching: Where Specifications require matching an established Sample, the Architect's decision will be final on whether a proposed product matches satisfactorily.

   a. Where no product available within the specified category matches satisfactorily and complies with other specified requirements, comply with provisions of the Contract Documents concerning "substitutions" for selection of a matching product in another product category.

8. Visual Selection: Where specified product requirements include the phrase "... as selected from manufacturer's standard colors, patterns, textures ..." or a similar phrase, select a product and manufacturer that complies with other specified requirements. The Architect will select the color, pattern, and texture from the product line selected.

PART 3 - EXECUTION

3.1 INSTALLATION OF PRODUCTS

   A. Comply with manufacturer's instructions and recommendations for installation of products in the applications indicated. Anchor each product securely in place, accurately located and aligned with other Work.

   1. Clean exposed surfaces and protect as necessary to ensure freedom from damage and deterioration at time of Substantial Completion.
PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This Section includes administrative and procedural requirements for handling requests for substitutions made after award of the Contract.

B. Related Sections: The following Sections contain requirements that relate to this Section:
   1. Division 1 Section "Reference Standards and Definitions" specifies the applicability of industry standards to products specified.
   2. Division 1 Section "Submittals" specifies requirements for submitting the Contractor's Construction Schedule and the Submittal Schedule.

1.3 DEFINITIONS

A. Definitions in this Article do not change or modify the meaning of other terms used in the Contract Documents.

B. Substitutions: Changes in products, materials, equipment, and methods of construction required by the Contract Documents proposed by the Contractor after award of the Contract are considered to be requests for substitutions.

1.4 SUBMITTALS

A. Substitution Request Submittal: The Architect will consider requests for substitution if received within 30 days after commencement of the Work. Requests received more than 30 days after commencement of the Work may be considered or rejected at the discretion of the Architect.
   1. Submit 3 copies of each request for substitution for consideration. Submit requests in the form and according to procedures required for change-order proposals.
   2. Architect's Action: If necessary, the Architect will request additional information or documentation for evaluation within one week of receipt of a request for substitution. The Architect will notify the Contractor of acceptance or rejection of the substitution within 2 weeks of receipt of the request, or one week of receipt of additional information or documentation, whichever is later. Acceptance will be in the form of a change order.
      a. Use the product specified if the Architect cannot make a decision on the use of a proposed substitute within the time allocated.

PART 2 - PRODUCTS

2.1 SUBSTITUTIONS

A. Post Award Submittal Instructions For Substitutions: The Architect will receive and consider the Contractor's request for substitution when one or more of the following conditions are satisfied, as determined by the Architect. If the following conditions are not satisfied, the Architect will return the requests without action except to record noncompliance with these requirements.
1. Extensive revisions to the Contract Documents are not required.
2. Proposed changes are in keeping with the general intent of the Contract Documents.
3. The request is timely, fully documented, and properly submitted.
4. The specified product or method of construction cannot be provided within the Contract Time. The Architect will not consider the request if the product or method cannot be provided as a result of failure to pursue the Work promptly or coordinate activities properly.
5. The request is directly related to an "or-equal" clause or similar language in the Contract Documents.
6. The requested substitution offers the Owner a substantial advantage, in cost, time, energy conservation, or other considerations, after deducting additional responsibilities the Owner must assume. The Owner's additional responsibilities may include compensation to the Architect for redesign and evaluation services, increased cost of other construction by the Owner, and similar considerations.

B. The Contractor's submittal and the Architect's acceptance of Shop Drawings, Product Data, or Samples for construction activities not complying with the Contract Documents do not constitute an acceptable or valid request for substitution, nor do they constitute approval.

PART 3 - EXECUTION (Not Applicable)

END OF SECTION
PART 1 - GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

A. This Section includes administrative and procedural requirements for cutting and patching.

B. Related Sections: The following Sections contain requirements that relate to this Section:

1. Division 1 Section "Coordination" for procedures for coordinating cutting and patching with other construction activities.
2. Division 2 Section "Selective Structure Demolition" for demolition of selected portions of the building for alterations.
3. Refer to other Sections for specific requirements and limitations applicable to cutting and patching individual parts of the Work.

1.03 SUBMITTALS

A. Cutting and Patching Proposal: Submit a proposal describing procedures well in advance of the time cutting and patching will be performed if the Owner requires approval of these procedures before proceeding. Request approval to proceed. Include the following information, as applicable, in the proposal:

1. Describe the extent of cutting and patching required. Show how it will be performed and indicate why it cannot be avoided.
2. Describe anticipated results in terms of changes to existing construction. Include changes to structural elements and operating components as well as changes in the building's appearance and other significant visual elements.
3. List products to be used and firms or entities that will perform Work.
4. Indicate dates when cutting and patching will be performed.
5. Utilities: List utilities that cutting and patching procedures will disturb or affect. List utilities that will be relocated and those that will be temporarily out-of-service. Indicate how long service will be disrupted.
6. Where cutting and patching involves adding reinforcement to structural elements, submit details and engineering calculations showing integration of reinforcement with the original structure.
7. Approval by the Architect to proceed with cutting and patching does not waive the Architect's right to later require complete removal and replacement of unsatisfactory work.
1.04  QUALITY ASSURANCE

A. Requirements for Structural Work: Do not cut and patch structural elements in a manner that would change their load-carrying capacity or load-deflection ratio.

1. Obtain approval of the cutting and patching proposal before cutting and patching the following structural elements:

   a. Bearing and retaining walls.
   b. Structural concrete.
   c. Structural steel.
   d. Lintels.
   e. Timber and primary wood framing.
   f. Structural decking.
   g. Miscellaneous structural metals.
   h. Equipment supports.
   i. Piping, ductwork, vessels, and equipment.

B. Operational Limitations: Do not cut and patch operating elements or related components in a manner that would result in reducing their capacity to perform as intended. Do not cut and patch operating elements or related components in a manner that would result in increased maintenance or decreased operational life or safety.

1. Obtain approval of the cutting and patching proposal before cutting and patching the following operating elements or safety related systems:

   a. Primary operational systems and equipment.
   b. Air or smoke barriers.
   c. Water, moisture, or vapor barriers.
   d. Membranes and flashings.
   e. Fire protection systems.
   f. Noise and vibration control elements and systems.
   g. Control systems.
   h. Electrical wiring systems.

C. Visual Requirements: Do not cut and patch construction exposed on the exterior or in occupied spaces in a manner that would, in the Architect's opinion, reduce the building's aesthetic qualities. Do not cut and patch construction in a manner that would result in visual evidence of cutting and patching. Remove and replace construction cut and patched in a visually unsatisfactory manner.

1. If possible retain the original Installer or fabricator to cut and patch the exposed Work listed below. If it is impossible to engage the original Installer or fabricator, engage another recognized experienced and specialized firm.

PART 2 – PRODUCTS – NOT USED
PART 3 - EXECUTION

3.01 INSPECTION

A. Examine surfaces to be cut and patched and conditions under which cutting and patching is to be performed before cutting. If unsafe or unsatisfactory conditions are encountered, take corrective action before proceeding.

1. Before proceeding, meet at the Project Site with parties involved in cutting and patching, including mechanical and electrical trades. Review areas of potential interference and conflict. Coordinate procedures and resolve potential conflicts before proceeding.

3.02 PREPARATION

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

B. Protection: Protect existing construction during cutting and patching to prevent damage. Provide protection from adverse weather conditions for portions of the Project that might be exposed during cutting and patching operations.

C. Avoid interference with use of adjoining areas or interruption of free passage to adjoining areas.

D. Avoid cutting existing pipe, conduit, or ductwork serving the building but scheduled to be removed or relocated (if necessary) until provisions have been made to bypass them.

3.03 PERFORMANCE

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

1. Cutting: Cut existing construction using methods least likely to damage elements retained or adjoining construction.

2. In general, where cutting, use hand or small power tools designed for sawing or grinding, not hammering and chopping. Cut holes and slots as small as possible, neatly to size required, and with minimum disturbance of adjacent surfaces. Temporarily cover openings when not in use.

3. To avoid marring existing finished surfaces, cut or drill from the exposed or finished side into concealed surfaces.

4. Cut through concrete using a cutting machine, such as a Carborundum saw or a diamond-core drill.
5. Comply with requirements of applicable Division 2 Sections where cutting and patching requires excavating and backfilling.
6. Where services are required to be removed, relocated, or abandoned, bypass utility services, such as pipe or conduit, before cutting. Cut-off pipe or conduit in walls or partitions to be removed. Cap, valve, or plug and seal the remaining portion of pipe or conduit to prevent entrance of moisture or other foreign matter after by-passing and cutting.

B. Patching: Patch with durable seams that are as invisible as possible. Comply with specified tolerances.

1. Where feasible, inspect and test patched areas to demonstrate integrity of the installation.

C. Warranty: Manufacturers’ Watertight Roofing System

1. Contractor’s responsibility to maintain Johns Manville PVC Membrane 5” ENERGY 3 Polyisocyanurate Insulation existing roofing material 15 yr warranty at all times during the cutting/patching process.
2. Copy of warranty included in this section for reference.

3.04 CLEANING

A. Clean areas and spaces where cutting and patching are performed. Completely remove paint, mortar, oils, putty, and similar items. Thoroughly clean piping, conduit, and similar features before applying paint or other finishing materials. Restore damaged pipe covering to its original condition.
PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Cleaning and maintenance of site premises.

1.2 REGULATORY REQUIREMENTS

A. Codes and Standards: Comply with applicable Federal, State and Local codes and regulations relative to environmental safety regulations.

B. Hazards Controls: Store volatile waste in covered metal containers and remove from premises daily. Prevent accumulation of wastes which create hazardous conditions.

C. Pollution Control:
   1. Do not burn or bury rubbish and waste materials on the project site.
   2. Do not dispose of volatile fluid wastes (such as mineral spirits, oil or paint thinner) in storm or sanitary sewer systems or into streams or waterways.
   3. Do not dispose of any toxic chemicals in storm or sanitary sewer systems. Comply with EPA requirements regarding disposal.

PART 2 - PRODUCTS

2.1 CLEANING MATERIALS

A. Use only cleaning materials recommended by manufacturer of surface to be cleaned.

B. Use cleaning materials only on surfaces recommended by cleaning material manufacturer.

C. Cleaning materials shall be clearly labeled and safely stored when not in use. Maintain control of cleaning materials while in use. Do not leave unattended. No flammable materials or liquids may be stored in the existing building or in the new addition.

PART 3 - EXECUTION

3.1 CLEANING REQUIREMENTS

A. Oversee cleaning and ensure that building and grounds are maintained free from accumulations of waste materials and rubbish.

B. In exterior work, sprinkle dusty debris with fine water mist to control accumulation of dust. Avoid puddling.

C. Vacuum clean interior building areas when ready to receive finish painting and continue vacuum cleaning on an as-needed basis until building is ready for acceptance or occupancy.

D. Schedule cleaning operations so that dust and other contaminants resulting from cleaning process will not fall on wet, newly-painted surfaces.

E. Clean exterior premises daily. Do not let debris enter customer areas.

3.2 TRASH REMOVAL
A. On a daily basis, clean work areas and access, and dispose of waste materials, rubbish and debris.

B. Do not allow waste materials, rubbish and debris to accumulate and become an unsightly or hazardous condition.

C. Keep streets and access to site free of rubbish and debris.

3.3 FINAL CLEANING

A. Execute final cleaning prior to final inspection as follows:
   1. Clean Project site, yard, and grounds, in areas disturbed by construction activities, including landscape development areas, of rubbish, waste material, litter, and other foreign substances.
   2. Sweep paved areas broom clean. Remove petrochemical spills, stains, and other foreign deposits.
   3. Rake grounds that are neither planted nor paved to a smooth, even-textured surface.
   4. Remove tools, construction equipment, machinery, and surplus material from Project site.
   5. Clean exposed exterior and interior hard-surfaced finishes to a dirt-free condition, free of stains, films, and similar foreign substances. Avoid disturbing natural weathering of exterior surfaces. Restore reflective surfaces to their original condition.
   6. Remove debris and surface dust from limited access spaces, including roofs, plenums, shafts, trenches, equipment vaults, manholes, attics, and similar spaces.
   7. Vacuum carpet and similar soft surfaces, removing debris and excess nap; shampoo if visible soil or stains remain.
   8. Vacuum clean all interior floor surfaces.
   9. Clean transparent materials, including mirrors and glass in doors and windows. Remove glazing compounds and other noticeable, vision-obscuring materials. Replace chipped or broken glass and other damaged transparent materials. Polish mirrors and glass, taking care not to scratch surfaces.
   10. Remove labels that are not permanent.
   11. Touch up and otherwise repair and restore marred, exposed finishes and surfaces. Replace finishes and surfaces that cannot be satisfactorily repaired or restored or that already show evidence of repair or restoration.
   12. Wipe surfaces of mechanical and electrical equipment and similar equipment. Remove excess lubrication, paint, and mortar droppings, and other foreign substances.
   13. Clean plumbing fixtures to a sanitary condition, free of stains, including stains resulting from water exposure.
   14. Replace disposable air filters and clean permanent air filters of equipment operated during construction. Clean exposed surfaces of diffusers, registers, and grills.
   15. Clean ducts, blowers, and coils if units were operated without filters during construction.
   16. Clean light fixtures, lamps, globes, and reflectors to function with full efficiency. Replace burned-out bulbs, and those noticeably dimmed by hours of use, and defective and noisy starters in fluorescent and mercury vapor fixtures.
   17. Leave Project clean and ready for occupancy.

B. Cleaning of Toilets Prior to Possession:
   1. Immediately prior to possession, clean toilets thoroughly including each toilet fixture and accessory.
   2. Clean entire wall and floor surfaces using cleaning solutions and wipe dry to prevent surface film or residue.
   3. Clean water closets and sinks with scrubbing cleansers to remove stains and deposits.
   4. Clean and polish stainless steel accessories and toilet partitions to a spotless luster using soap, ammonia, or mild detergent and water. Apply with sponge or soft cloth, rinse with clear water, and wipe dry. As an alternate, use a commercial stainless steel cleaner and polish.
5. Clean mirror surfaces using glass cleaner.

C. Employ skilled workmen for final cleaning.

D. Prior to final completion or Owner possession, conduct an inspection of sight-exposed interior and exterior surfaces and all work areas with the Owner’s Program Manager or Representative to verify that entire Work is clean.

END OF SECTION
PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This Section includes administrative and procedural requirements for warranties required by the Contract Documents, including manufacturer's standard warranties on products and special warranties.

1. Refer to the General Conditions for terms of the Contractor's period for correction of the Work.

B. Related Sections: The following Sections contain requirements that relate to this Section:

1. Division 1 Section "Submittals" specifies procedures for submitting warranties.
2. Division 1 Section "Project Closeout" specifies contract closeout procedures.
3. Divisions 2 through 16 Sections for specific requirements for warranties on products and installations specified to be warranted.
4. Certifications and other commitments and agreements for continuing services to Owner are specified elsewhere in the Contract Documents.

C. Disclaimers and Limitations: Manufacturer's disclaimers and limitations on product warranties do not relieve the Contractor of the warranty on the Work that incorporates the products. Manufacturer's disclaimers and limitations on product warranties do not relieve suppliers, manufacturers, and subcontractors required to countersign special warranties with the Contractor.

D. Separate Prime Contracts: Each prime contractor is responsible for warranties related to its own contract.

1.3 DEFINITIONS

A. Standard product warranties are preprinted written warranties published by individual manufacturers for particular products and are specifically endorsed by the manufacturer to the Owner.

B. Special warranties are written warranties required by or incorporated in the Contract Documents, either to extend time limits provided by standard warranties or to provide greater rights for the Owner.

1.4 WARRANTY REQUIREMENTS

A. Related Damages and Losses: When correcting failed or damaged warranted construction, remove and replace construction that has been damaged as a result of such failure or must be removed and replaced to provide access for correction of warranted construction.
B. Reinstatement of Warranty: When Work covered by a warranty has failed and been corrected by replacement or rebuilding, reinstate the warranty by written endorsement. The reinstated warranty shall be equal to the original warranty with an equitable adjustment for depreciation.

C. Replacement Cost: Upon determination that Work covered by a warranty has failed, replace or rebuild the Work to an acceptable condition complying with requirements of the Contract Documents. The Contractor is responsible for the cost of replacing or rebuilding defective Work regardless of whether the Owner has benefited from use of the Work through a portion of its anticipated useful service life.

D. Owner's Recourse: Expressed warranties made to the Owner are in addition to implied warranties and shall not limit the duties, obligations, rights, and remedies otherwise available under the law. Expressed warranty periods shall not be interpreted as limitations on the time in which the Owner can enforce such other duties, obligations, rights, or remedies.

1. Rejection of Warranties: The Owner reserves the right to reject warranties and to limit selection to products with warranties not in conflict with requirements of the Contract Documents.

E. Where the Contract Documents require a special warranty, or similar commitment on the Work or part of the Work, the Owner reserves the right to refuse to accept the Work, until the Contractor presents evidence that entities required to countersign such commitments are willing to do so.

1.5 SUBMITTALS

A. Submit written warranties to the Architect prior to the date certified for Substantial Completion. If the Architect's Certificate of Substantial Completion designates a commencement date for warranties other than the date of Substantial Completion for the Work, or a designated portion of the Work, submit written warranties upon request of the Architect.

1. When a designated portion of the Work is completed and occupied or used by the Owner, by separate agreement with the Contractor during the construction period, submit properly executed warranties to the Architect within 15 days of completion of that designated portion of the Work.

B. When the Contract Documents require the Contractor, or the Contractor and a subcontractor, supplier or manufacturer to execute a special warranty, prepare a written document that contains appropriate terms and identification, ready for execution by the required parties. Submit a draft to the Owner, through the Architect, for approval prior to final execution.

C. Forms for special warranties are included at the end of this Section. Prepare a written document utilizing the appropriate form, ready for execution by the Contractor, or by the Contractor, subcontractor, supplier, or manufacturer. Submit a draft to the Owner, through the Architect, for approval prior to final execution.
1. Refer to individual specification sections and Construction Drawings for specific content requirements and particular requirements for submitting special warranties.

D. Form of Submittal: At Final Completion compile 2 copies of each required warranty properly executed by the Contractor, or by the Contractor, subcontractor, supplier, or manufacturer. Organize the warranty documents into an orderly sequence based on the table of contents of the Project Manual.

E. Bind warranties and bonds in heavy-duty, commercial-quality, durable 3-ring, vinyl-covered loose-leaf binders, thickness as necessary to accommodate contents, and sized to receive 8-1/2-by-11-inch (115-by-280-mm) paper.

1. Provide heavy paper dividers with celluloid covered tabs for each separate warranty. Mark the tab to identify the product or installation. Provide a typed description of the product or installation, including the name of the product, and the name, address, and telephone number of the Installer.

2. Identify each binder on the front and spine with the typed or printed title "WARRANTIES," Project title or name, and name of the Contractor.

3. When warranted construction requires operation and maintenance manuals, provide additional copies of each required warranty, as necessary, for inclusion in each required manual.

PART 2 - PRODUCTS (Not Applicable)

PART 3 - EXECUTION

3.1 LIST OF WARRANTIES

A. Schedule: Provide warranties on Products and Installations for all elements of work included in the scope of this project.

END OF SECTION
1.1 SUMMARY:

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

B. Section Includes
   1. Descriptions of Requirements.
   2. Closeout Procedures.
   3. Final Closeout Submittals.
   4. Project Record Documents.
   5. Operations and Maintenance Data.
   6. Warranties and Bonds.

1.2 DESCRIPTION OF REQUIREMENTS:

A. Definitions:
   1. Project closeout is the term used to describe certain collective project requirements, indicating completion of the work that are to be fulfilled near the end of the Contract time in preparation for final acceptance and occupancy of the work by the Owner, as well as final payment to the Contractor and the normal termination of the Contract.

   2. Substantial Completion shall be the term as defined by the Contract, including General and Supplemental Conditions.

   3. Final Completion shall be the term as defined by the Contract, including General and Supplemental Conditions.

B. Time of closeout is directly related to “Substantial Completion”; therefore, the time of closeout may be either a single time period for the entire work or a series of time periods for individual elements of the work (phases) that have been certified as substantially complete at different dates. This time variation, if any, shall be applicable to the other provisions of this section.

1.3 CLOSEOUT PROCEDURES:

A. General: Comply with closeout submittal requirements defined within individual Sections. Submittal procedures described herein shall apply unless described in individual Sections.

B. Compete all work covered in the Contract Documents before requesting the Architect/Engineer’s inspection for certification of substantial completion, either for the entire work or for portions of the work.
C. When Contractor considers Work to be Substantially Complete, submit written certification to Owner’s Representative and Architect as follows:
   1. Contract Documents have been reviewed.
   2. Work has been inspected.
   3. Work is complete in accordance with Contract Documents.
   4. Work is ready for inspection.
   5. Request the Architect/Engineer’s inspection for certification of substantial completion. Provide a punch list of known exceptions (a comprehensive list of items to be completed or corrected prior to final payment) in the request.

D. Substantial Completion Inspection: Upon receipt of Contractor's written certification and request for the Architect/Engineer’s inspection for certification of substantial completion, the Architect/Engineer shall make an inspection to determine whether or not the Work is substantially complete.
   1. If Architect’s inspection discloses any item which is not sufficiently complete in accordance with the Contract Documents:
      a. A certificate of Substantial completion will not be issued.
      b. The Architect will provide the Contractor a list of items that shall be completed or corrected in order to achieve Substantial Completion.
      c. The Contractor shall promptly complete or correct all items indicated in order to achieve Substantial Completion.
      d. Contractor shall provide to Architect documented evidence of items completed in the format acceptable to Architect.
   2. When Work is substantially complete, the Architect will prepare and submit the Certificate of Substantial Completion in accordance with the Contract.

E. In the progress payment following the date substantial completion complete the administrative actions and submittals indicated in Section 01250 for Application for payment at Substantial Completion.
   1. Include supporting documentation for completion as indicated in these contract documents.
   2. Submit a statement showing an accounting of changes to the Contract Sum.
   3. Advise Owner of pending insurance changeover requirements.
   4. Submit specific warranties, workmanship/maintenance bonds, maintenance agreements, final certifications and similar documents, and test and balance reports.
   5. Obtain and submit releases enabling the Owner's full, unrestricted use of the work and access to services and utilities. Where required, include occupancy permits, operating certificates, and similar releases.
   6. Deliver extra stock of material and similar physical items to the Owner.
7. Make the final changeover of locks and transmit the keys to the Owner. Advise the Owner’s personnel of the changeover in security provisions.

8. Complete start-up testing of systems, and instruction of the Owner’s operating and maintenance personnel. Discontinue or change over and remove temporary facilities and services from the project site, along with construction tools and facilities, mockups, and similar elements.

9. Complete final cleaning up requirements, including touch-up painting of marred surfaces.

10. Touch-up and otherwise repair and restore marred exposed finishes.

11. Inspection Procedures: See General and Supplementary Conditions.

F. Final Inspection: Upon receipt of Contractors written notice that Work, including punch list items resulting from earlier inspection, has been completed and is ready for final inspection and acceptance and having received the final Application for payment, the Architect will make an inspection. When the Architect finds the Work acceptable under the Contract Documents and the Contract fully performed, the Architect will issue the Final Certificate of Payment.

G. Reinspection Procedures: The Architect/Engineer will reinspect the Work upon receipt of the Contractor’s notice that the Work, including punch-list items resulting from earlier inspection, has been completed, except for these items whose completion has been delayed because of circumstances that are acceptable to the Architect/Engineer.

1. Upon completion of reinspection, the Architect/Engineer will either recommend of final acceptance to the Owner, advise the Contractor of Work that is incomplete or of obligations that have not been fulfilled, but are required for final acceptance.

2. If necessary, the reinspection procedure will be repeated. All reinspections by the Architect/Engineer from this point are considered additional services, and shall be performed at the expense of the Contractor.

1.4 FINAL CLOSEOUT SUBMITTALS:

A. General Closeout Submittals: Complete the following before requesting the Architect/Engineer’s final inspection for recommendation of final acceptance and final payment as required by the General Conditions. List known exceptions, if any, in the request.

B. Specific Closeout Submittals: Closeout submittals are submittals specified in the individual sections as “Closeout” and shall not be otherwise considered a closeout document regardless of the type of submittal. Submittals not classified as a closeout submittal shall be considered a regular submittal under the provisions of Section 01330. For example: Maintenance Data may, or may not, be classified as a closeout unless specifically identified as a closeout in the individual section Part 1 SUBMITTAL paragraph.
C. Unless otherwise specified in the individual sections, submit closeout submittals to the Owner within 90 days after Substantial Completion of the Work.

D. All closeout documents specified in the individual sections shall be submitted. Specific documents listed below shall be included separately in hard copy format and an Electronic Closeout Document Submission as specified hereinafter.

E. Final closeout submittals shall be received and approved by Owner before final application for payment will be approved.

   1. Submit the final payment request with final releases and supporting documentation not previously submitted and accepted. Include certificates of insurance for products and completed operations where required.

   2. Submit a certified copy of the Architect/Engineer's final punch-list of itemized work to be completed or corrected, stating that each item has been completed or otherwise resolved for acceptance.

   3. Submit final meter readings for utilities, a measured record of stored fuel, and similar data either as of the date of Substantial Completion, or else when the Owner took possession of and responsibility for corresponding elements of the Work.

   4. Submit consent of surety to final payment, AIA Document G707, (4 copies with original signatures).

   5. Submit a final liquidated damages settlement statement, acceptable to the Owner.

   6. Submit Statutory Affidavit (4 copies with original signatures).

   7. Submit evidence of final, continuing insurance coverage complying with insurance requirements.

   8. Submit Certificate and Release (4 copies with original signatures).

1.5 ELECTRONIC CLOSEOUT DOCUMENT SUBMISSION:

   A. Submit 2 sets of CD's of all documents provided in closeout submittal package.

   B. If Contractor fails to provide a fully completed Electronic Closeout Document Submission within 90 days after Substantial Completion of the Work, then Contractor agrees to pay Owner the sum of $250.00 per day, as liquidated damages and not as a penalty, until the fully completed Electronic Closeout Document Submission is received and approved by Architect.

   C. Contractor shall upload of specific project information to database referenced in section 01790.
D. Architect’s/Engineer’s review of the closeout submittal package shall be limited to (2) two reviews as part of basic services. Additional reviews shall be performed at the expense of the Contractor.

1.6 PROJECT RECORD DOCUMENTS:

A. General: Specific requirements for record documents are indicated in the individual sections of these specifications. Other requirements are indicated in the General and Supplementary Conditions. General submittal requirements are indicated in the various “submittals” sections.

1. Do not use record documents for construction purposes; protect from deterioration and loss in a secure, fire-resistive location; provide access to record documents for the Architect’s and Clerk-of-the-Work’s reference during normal working hours.

B. Maintain on site one set of the following record documents. Record actual revisions to the Work.
2. Specifications
3. Addenda
4. Change Orders and other Modifications to the Contract.
5. Reviewed shop drawings, product data, and samples.

C. Maintain Record Documents separate from documents used for construction.

D. As-built Record Documents and Shop Drawings: Record as-builts shall be maintained and submitted for the primary purpose of recording the locations for concealed interior and exterior underground utilities as specified in the individual specifications. Legibly record actual measured horizontal and vertical locations of interior and exterior underground utilities and appurtenances, referenced to permanent surface improvements. Mark up the set of record documents to show the actual installation where the installation work varies substantially from the Work as originally shown. Mark whichever drawing is most capable of showing the actual “field” condition fully and accurately; however, where Shop Drawings are used for markup, record a cross-reference at the corresponding location on the working drawings. Give particular attention to concealed work that would be difficult to measure and record at a later date

1. Mark record sets with red erasable pencil and, where feasible, use other colors to distinguish between variations in separate categories of the work.
2. Mark-up new information which is known to be important to the Owner, but for some reason was not shown on either Contract Drawings or Shop Drawings.
3. Note related change-order numbers where applicable.
4. Organize record drawing sheets into manageable sets, bind with durable-paper cover sheets; and print suitable titles, dates, and other identification on the cover of each set.

E. Record required as-built information concurrent with construction progress. Do not permanently conceal work until required information has been recorded.
F. At Project completion, the Contractor shall place one set the Record Documents (including Building and Civil Record Drawings, Specifications, Addenda, and Change Orders) enclosed in a plastic pipe tube (fixed cap at one end and a threaded-cap on the other end) for storage in the Electrical Room.

1.7 OPERATION AND MAINTENANCE DATA:

A. Manuals: Organize operating and maintenance data into at least three (3) suitable sets of manageable size. Bind data into individual binders, properly identified and indexed. Bind each set of data in heavy-duty, 2-inch, 3-ring, vinyl-covered binders, with pocket folders for folded sheet information. Mark appropriate identification on both front and spine of each binder.

B. Include the following types of information in operation and maintenance manuals:
1. Emergency instructions.
2. Spare parts list.
4. Wiring diagrams.
5. Recommended “turn-around” cycles.
6. Inspection procedures.
7. Shop Drawings and Product Data.
8. Additional requirements specified in Mechanical and Electrical Divisions.

1.8 WARRANTIES AND BONDS:

A. Submit required warranties and bonds
1. Assemble documents from Subcontractors, suppliers, and manufacturers.
2. For equipment put into use with Owner’s acceptance during construction, submit within ten days after first operation, listing date of acceptance as start of warranty period.
3. For items of Work delayed materially beyond Date of Substantial Completion, provide updated submittal within ten days after acceptance, listing date of acceptance as start of warranty period.

PART 2 - PRODUCTS (Not Applicable)

PART 3 - EXECUTION

3.1 CLOSEOUT TRAINING, DEMONSTRATION, AND INSTRUCTIONS:

A. General Operation and Maintenance Instructions: Arrange for each Installer of operating equipment and other work that requires regular or continuing maintenance, to meet at the site with the Owner’s personnel and Clerk-of-the-works to provide necessary basic instruction in proper operation and maintenance of the entire work. Where installers are not experienced in the required procedures, include instruction by the manufacturer’s representatives.

1. As part of this instruction, provide a detailed review of the following items:
a) Maintenance manuals.
b) Record documents.
c) Spare parts and materials.
d) Identification systems.
e) Control sequences.
f) Hazards.
g) Cleaning.
h) Warranties and bonds maintenance agreements and similar continuing commitments.

B. As part of this instruction for operating equipment, demonstrate the following procedures:

1. Startup.
2. Shutdown.
3. Emergency operations.
5. Safety procedures.
7. Effective energy utilization.

3.2 FINAL CLEANING:

A. General: Special cleaning requirements for specific units of work are included in the appropriate sections of the other Divisions of the Specifications. General cleaning during the regular progress of the work is required by the General Conditions and is also included under Section 01500 – TEMPORARY FACILITIES AND CONTROLS.

B. Cleaning: Provide final cleaning of the work at the time indicated. Employ experienced workers or professional cleaners for final cleaning. Clean each surface or unit of work to the condition expected from a normal, commercial building cleaning and maintenance program. Comply with manufacturer's instructions for operations.

1. Complete the following cleaning operations before requesting the Architect/Engineer's inspection for final acceptance or certification of Substantial Completion.

2. Remove labels which are not required as permanent labels.

3. Clean transparent materials, including mirrors and glass in doors and windows, to a polished condition. Remove putty and other substances which are noticeable as vision-obscuring materials. Replace chipped or broken glass and other damaged transparent materials.

4. Clean exposed exterior and interior hard-surfaced finishes to a condition that is free of dust, stains, films, and similar noticeable distracting substances. Restore reflective surfaces to their original reflective condition. Leave concrete floors broom clean. Vacuum carpeted surfaces.

6. Clean the project site, including landscape development areas, of rubbish, litter, and other foreign substances. Sweep paved areas to a broom clean condition; remove stains, spills, and other foreign deposits. Rake grounds that are neither paved nor planted, to a smooth even-textured surface.

C. Removal of Protection: Except as otherwise indicated or requested by the Architect/Engineer, remove temporary protection devices and facilities which were installed during the course of the work to protect previously completed work during the remainder of the construction period.

D. Compliance: Comply with safety standards and governing regulations for cleaning operations. Do not burn waste materials at the site. Do not bury debris or excess materials on the Owner's property. Do not discharge volatile or other harmful or dangerous materials into drainage system. Remove waste materials from the site and dispose of in a lawful manner.

1. Where extra materials of value remaining after completion of associated work have become the Owner's property, dispose of these materials to the Owner's best advantage as directed.

END OF SECTION
1.1 SUMMARY:

A. Work covered in this section includes:
   1. Requirements for electronic submittal of Warranties, Project Records and Project Related Data.
   2. Contractor Warranty Form
   3. Subcontractor or Installer Warranty Form
   4. Contractor Self Performing Trade Work or Installation Warranty Form
   5. Contractor Affidavit Certifying that Specific Requested Documentation is Not Applicable
   6. Contractor Exit Affidavit

B. Related Sections
   1. Section 01770 Project Closeout.
   2. Section 01740 Warranties.

1.2 DESCRIPTION OF REQUIREMENTS:

A. General: Where the Contract Documents require submittals as directed by the Owner, Architect or other Owner's Representative, those items shall be submitted as otherwise directed. This section refers to data required from the Contractor to populate the Owner's electronic project database and provides instructions for the collection of select project documents and data in electronic form. Those select items are listed below in this Section. Items listed in this Section may be the same, similar or related to items requested by others or as otherwise indicated in the Contract documents. The Contractor may request of others collecting documentation on behalf of the Owner, if items required by this Section will suffice in whole or in part as substitution for items otherwise requested. Items of this Section shall be provided as directed in this Section. Waiver or substitution of items required by this Section is not allowed.

1.3 SUBMITTAL PROCESS:

A. General: Documents and data collected for the project are electronic in nature. Contractor shall have access to the internet to fulfill the requirements of this Section. Within five (5) days of Contract execution, Contractor shall register himself as a user of the system by going to the website www.FDT4contractors.com, by emailing to contractorsupport@fdtech1.com or by calling 1-844-fdtech1. Once registered, the Contractor may access his Dashboard. Project may be shown on the Dashboard if previously set up by the Owner. If project is not shown, follow the instructions to Add a Project.

1.3 ELECTRONIC FORMS:

A. General: Upon access to the Owner's Database, Contractor shall be asked to complete electronic forms. Follow instructions to complete required electronic forms. Applicable electronic data forms from the following list shall be completed by Contractor. List is subject to change.
   1. Contractor Information.
2. General Project Information
3. Project Details
4. Area of Work
5. Contract Documents
6. Permits
7. Photos
8. Subcontractors of Installers
9. Product Information
10. GC and Installer Warranties
11. Change Orders and Other Contract Documents
12. As-builts
13. Test
14. Closeout Dates

1.4 ELECTRONIC SUBMITTALS:

A. The following minimum documents shall be electronically provided by Contractor into the electronic database.

1. All required permits (Building Permit, Site Development Permit, Mechanical Permit, Electrical Permit, Plumbing Permit, Right-of-Way Permit, Fire Systems Permit, any other permits obtained in the performance of the Project).


3. As-built Plans.

4. All test reports (Test & Balance, Concrete, all other test reports).

5. Certificate of Completion or Certificate of Occupancy.

6. Sub-Contractor and Installer list complete with Company Name, Contact Person, Address, email, phone and fax.

7. Substantial Completion form, fully executed.
8. Final Completion form, fully executed.
9. Project Photos
10. Product Data
11. Operation and Maintenance documents, submitted as separate electronic file per item
12. Manufacturer Warranties, fully executed, project specific, submitted as separate electronic file per item
13. Tests
14. Contractor Warranty Form, fully executed
15. Subcontractor of Installer Warranty forms, fully executed, submitted as separate electronic file per item
16. Contractor Self Performing Trade Work or Installation Warranty Form.
17. Manufacturer Warranties, fully executed, project specific, submitted as separate electronic file per item.
18. Contractor Affidavit Certifying that Requested Documentation is Not Applicable, per document where applicable, fully executed.
20. Competed Electronic Forms provided in the database.

B. Format: Uploaded documents shall be provided in *.pdf format, with the exception of photos. Photos shall be submitted as *.jpg.

C. Size: *.pdf shall be no larger than size indicated by the system instructions. *.jpg shall be no larger than size indicated by the system instructions.
D. Final Naming: File names shall representative of the document therein. File names shall be no longer than fifteen (15) characters. Other file naming instructions may be applicable as indicated in the database.

PART 2 - PRODUCTS (Not Applicable)

PART 3 - EXECUTION

3.1 TIME:

A. Contractor shall register to enter the electronic database within 5 days of Contract Execution.

B. Contractor shall complete Sections 1 through 5 of the electronic forms within 10 days of Contract Execution. Those sections are entitled, Contractor Information, General Project Information, Project Details, Areas of Work and Contract Documents

C. Contractor shall submit permit information and upload permit documents within 5 days of receipt of permits.

D. Contractor shall submit minimum 5 existing conditions photos in Section 7 of the electronic forms within 15 days of Contract Execution.

E. Contractor shall enter subcontractors and installers into database within 5 days of engaging said sub-contractor or installer to work on Owner's site.

F. Contractor shall begin submitting all other data as early as it is available.

G. Contractor shall complete all submittals of this Section as a pre-requisite to project close-out for this project.

END OF SECTION
CONTRACTOR WARRANTY FORM

PROJECT:
LOCATION:
OWNER:

I/We, ____________________________________________ (Company under Contract with Owner), Contractor for the above referenced project, do hereby warrant that all labor and work performed are in accord with Contract Documents and are of professional quality and all materials and equipment furnished are of good quality and new unless otherwise allowed in the Contract Documents. Contractor warrants all will be free from defects due to defective materials or workmanship for a period of one year from Date of Substantial Completion or other Date of Acceptance as approved by the Owner. Contractor further warrants that workmanship or installation shall not result in void of warranty by any manufacturer of products or equipment installed. Such additional guarantee by the Contractor regarding manufacturer’s warranties shall survive for the full term of the manufacturer’s warranty, which may be beyond the one year indicated in the standard Contractor warranty period.

This warranty commences on __________________________ (Date Accepted by Owner) . The warranty expires on midnight __________________________ (One year from Date Accepted by Owner), EXCEPT where any work of Contractor results in void of manufacturer’s warranty. The Contractor shall additionally warrant the work to a period consistent with the warranty term of the applicable manufacturer’s warranty in the case where Contractor’s work under the contract is found to have caused a manufacturer’s warranty to be voided.

Should any defect develop during the warranty period due to improper materials, workmanship or arrangement, the same, including adjacent work displaced, shall be made good by the undersigned at no expense to the Owner.

The Owner will give Contractor written notice of defective work. Where the Contractor fails to correct defective work within 30 days after receiving written notice, the Owner may, if he chooses, correct defects and charge Contractor costs for such correction. Contractor agrees to pay such charges upon demand from the Owner.

Nothing in the above shall be deemed to apply to work which has been abused, neglected or otherwise misused or unmaintained by the Owner, representatives of the Owner or others.

Guarantor: ____________________________________________
             (Contractor under contract with Owner)

By: __________________________________________________
    (Print Name)

Title: ________________________________________________
       (Print Title)

Signature: ____________________________________________
            (Above Named indicates he/she is an authorized representative of Guarantor):

Notary Public: ________________________________

My Commission Expires _____________________________

This ______ day of ______________, 20__.

END OF FORM
SUBCONTRACTOR OR INSTALLER WARRANTY FORM

PROJECT:

LOCATION:

OWNER:

I/We, _______________________, Subcontractor to _______________________, Subcontractor to _______________________, Subcontractor to _______________________, do hereby warrant that all labor and work performed are in accord with Contract Documents and are of professional quality and all materials and equipment furnished are of good quality and new unless otherwise allowed in the Contract Documents. Sub-contractor warrants all will be free from defects due to defective materials or workmanship for a period of __________ year(s) from Date of Substantial Completion or other Date of Acceptance as approved by the Owner. Sub-contractor further warrants that workmanship or installation shall not result in void of warranty by any manufacturer of products or equipment installed. Such additional guarantee by the Sub-contractor regarding manufacturer’s warranties shall survive for the full term of the manufacturer’s warranty, which may be beyond the year(s) indicated in the standard Sub-contractor warranty period indicated above.

This warranty commences on ______________________ (Date Accepted by Owner). The warranty expires on midnight ______________________ (_________) year(s) from Date Accepted by Owner, EXCEPT where any work of sub-contractor results in void of manufacturer’s warranty. The Sub-contractor shall additionally warrant the work to a period consistent with the warranty term of the applicable manufacturer’s warranty in the case where Sub-contractor’s work is found to have caused a manufacturer’s warranty to be voided.

Should any defect develop during the warranty period due to improper materials, workmanship or arrangement, the same, including adjacent work displaced, shall be made good by the undersigned at no expense to the Owner. The Owner will give Sub-contractor written notice of defective work. Where the Sub-contractor fails to correct defective work within 30 days after receiving written notice, the Owner may, if he chooses, correct defects and charge sub-contractor costs for such correction. Contractor and Subcontractor individually and collectively agree to pay such charges upon demand from the Owner.

Nothing in the above shall be deemed to apply to work which has been abused, neglected or otherwise misused or unmaintained by the Owner, representatives of the Owner or others.

Guarantor: _______________________, Guarantor: _______________________,
(Subcontractor or Installer) (General Contractor)
By: _______________________, By: _______________________,
(Print Name) (Print Name)
Title: _______________________, Title: _______________________,
(Print Title) (Print Title)
Signature: _______________________, Signature: _______________________,
(Above Named Signatories indicate he/she are authorized representative of Respective Guarantors)

Notary Public: _______________________,
My Commission Expires _______________________,
This _____ day of ____________, 20__.

END OF FORM
CONTRACTOR SELF PERFORMING TRADE WORK OR INSTALLATION WARRANTY FORM

PROJECT:
LOCATION:
OWNER:

I/We, ____________________________ (General Contractor Company Name) __ have SELF PERFORMED the specific trade work and/or Installation for _______________________; (List ONE trade only. Use additional sheets for more trades) as described in Specification Section(s) _____________________________. (List Appropriate Sections of Specifications, as applicable) do hereby warrant that all labor and work performed are in accord with Contract Documents and are of professional quality and all materials and equipment furnished are of good quality and new unless otherwise allowed in the Contract Documents. Sub-contractor warrants all will be free from defects due to defective materials or workmanship for a period of _______________ year(s) from Date of Substantial Completion or other Date of Acceptance as approved by the Owner. Contractor further warrants that workmanship or installation shall not result in void of warranty by any manufacturer of products or equipment installed. Such additional guarantee by the Contractor regarding manufacturer’s warranties shall survive for the full term of the manufacturer’s warranty, which may be beyond the year(s) indicated in the standard Sub-contractor warranty period indicated above.

This warranty commences on _____________________________ (Date Accepted by Owner). The warranty expires on midnight _____________________________ (______ ) year(s) from Date Accepted by Owner, EXCEPT where any work of Contractor results in void of manufacturer’s warranty. The Contractor shall additionally warrant the work to a period consistent with the warranty term of the applicable manufacturer’s warranty in the case where Sub-contractor’s work under is found to have caused a manufacturer’s warranty to be voided.

Should any defect develop during the warranty period due to improper materials, workmanship or arrangement, the same, including adjacent work displaced, shall be made good by the undersigned at no expense to the Owner. The Owner will give Contractor written notice of defective work. Where the Contractor fails to correct defective work within 30 days after receiving written notice, the Owner may, if he chooses, correct defects and charge Contractor costs for such correction. Contractor agrees to pay such charges upon demand from the Owner.

Nothing in the above shall be deemed to apply to work which has been abused, neglected or otherwise misused or unmaintained by the Owner, representatives of the Owner or others.

Guarantor: _______________________________________
            (Contractor)
By: _______________________________________________
    (Print Name)
Title: ______________________________________________
       (Print Title)
Signature: __________________________________________
           (Above Named Signatory indicates he/she is the authorized representative of Guarantor)

Notary Public: _______________________________________
My Commission Expires _____________________________
This ______ day of ____________________, 20__.

END OF FORM
CONTRACTOR AFFIDAVIT CERTIFYING THAT REQUESTED SPECIFIC DOCUMENTATION IS NOT APPLICABLE

PROJECT: 
LOCATION: 
OWNER: 

I/We, ___________________________________ (Contractor Company Name) , Contractor for the above referenced project, do hereby warrant that ____________________________________ (Title of Specific Document or Item, Enter ONE document or Item per Affidavit. Use additional sheets if other documents or items apply) was requested by the data collection system is Not Applicable to the Project indicated above. The specific document or item requested is Not Applicable because

__________________________________________________________________________

__________________________________________________________________________

(Enter all relevant details as to why the above named document or item is not applicable).

Affiant: ___________________________________
(Contractor)

By: _________________________________
(Print Name)

Title: _________________________________
(Print Title)

Signature: _______________________________
(Above Named Signatory indicates he/she is the authorized representative of Guarantor)

Notary Public: _________________________________

My Commission Expires _______________________
This _______ day of _________________, 20___.
CONTRACTOR EXIT AFFIDAVIT

PROJECT:

LOCATION:

OWNER:

I/We, ___________________________ (Contractor Company Name), Contractor for the above referenced project, do hereby warrant the following:

1. That CONTRACTOR WARRANTY has been properly executed and submitted by Contractor.

2. That all sub-contractors and Installers who have provided services on the project have properly executed a SUBCONTRACTOR OR INSTALLER WARRANTY as necessary for each area of work and that each has been submitted by Contractor.

3. That where Contractor Self-Performed trade work or installation, a properly executed CONTRACTOR SELF PERFORMING TRADE WORK OR INSTALLATION WARRANTY has been completed and submitted by Contractor.

4. That all requested Manufacturer’s Warranties have been prepared specific for this project and submitted by Contractor.

5. That Operations and Maintenance manuals have been provided for all project elements.

6. That designated Owner Representative have been appropriately trained on the operation of all equipment and systems.

7. That spare parts and excess materials have been provided to designated Owner Representative, where required.

8. That all requested or required data has been provided for storage on the Owner’s electronic database.

9. That all information and documentation provided on products and services is complete and correct to the Contractor’s knowledge.

Affiant: ___________________________
(Contractor)

By: ___________________________
(Print Name)

Title: ___________________________
(Print Title)

Signature: _______________________
(Above Named Signatory indicates he/she is the authorized representative of Guarantor)

Notary Public: __________________

My Commission Expires __________________

This ______ day of _____________, 20___.

END OF DOCUMENT
PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:
   1. Protecting existing vegetation to remain.
   2. Removing existing vegetation.
   3. Clearing and grubbing.
   4. Stripping and stockpiling topsoil.
   5. Removing above- and below-grade site improvements.
   6. Disconnecting, capping or sealing, and removing site utilities.
   7. Temporary erosion- and sedimentation-control measures.

B. Related Sections:
   Division 02 Section "Structure Demolition" for demolition of buildings, structures, and site improvements.

1.3 DEFINITIONS

A. Subsoil: All soil beneath the topsoil layer of the soil profile, and typified by the lack of organic matter and soil organisms.

B. Surface Soil: Soil that is present at the top layer of the existing soil profile at the Project site. In undisturbed areas, the surface soil is typically topsoil; but in disturbed areas such as urban environments, the surface soil can be subsoil.

C. Topsoil: Top layer of the soil profile consisting of existing native surface topsoil or existing in-place surface soil and is the zone where plant roots grow. Its appearance is generally friable, pervious, and black or a darker shade of brown, gray, or red than underlying subsoil; diameter; and free of subsoil and weeds, roots, toxic materials, or other nonsoil materials.

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

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

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

1.4 MATERIAL OWNERSHIP
A. Except for stripped topsoil and other materials indicated to be stockpiled or otherwise remain Owner's property, cleared materials shall become Contractor's property and shall be removed from Project site.

1.5 SUBMITTALS

A. Existing Conditions: Documentation of existing trees and plantings, adjoining construction, and site improvements that establishes preconstruction conditions that might be misconstrued as damage caused by site clearing.
   1. Use sufficiently detailed photographs or videotape. Include plans and notations to indicate specific wounds and damage conditions of each tree or other plants designated to remain.
B. Record Drawings: Identifying and accurately showing locations of capped utilities and other subsurface structural, electrical, and mechanical conditions.

1.6 QUALITY ASSURANCE

A. Pre-installation Conference: Location TBD

1.7 PROJECT CONDITIONS

A. Traffic: Minimize interference with adjoining roads, streets, walks, and other adjacent occupied or used facilities during site-clearing operations.
   1. Do not close or obstruct streets, walks, or other adjacent occupied or used facilities without permission from Owner and authorities having jurisdiction.
   2. Provide alternate routes around closed or obstructed traffic ways if required by Owner or authorities having jurisdiction.
B. Salvable Improvements: Carefully remove items indicated to be salvaged and store on Owner's premises where indicated.
C. Utility Locator Service: Notify Call 811 Before You Dig for area where Project is located before site clearing.
D. Do not commence site clearing operations until temporary erosion- and sedimentation-control measures are in place.
E. The following practices are prohibited within protection zones:
   1. Storage of construction materials, debris, or excavated material.
   2. Parking vehicles or equipment.
   3. Foot traffic.
   4. Erection of sheds or structures.
   5. Impoundment of water.
   6. Excavation or other digging unless otherwise indicated.
   7. Attachment of signs to or wrapping materials around trees or plants unless otherwise indicated.
F. Soil Stripping, Handling, and Stockpiling: Perform only when the topsoil is dry or slightly
moist.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Satisfactory Soil Material: Requirements for satisfactory soil material are specified in Division 2 Section "Earth Moving."
   1. Obtain approved borrow soil material off-site when satisfactory soil material is not available on-site.

B. Antirust Coating: Fast-curing, lead- and chromate-free, self-curing, universal modified-alkyd primer complying with MPI #79, Alkyd Anticorrosive Metal Primer or SSPC-Paint 20 or SSPC-Paint 29 zinc-rich coating.
   1. Use coating with a VOC content of 420 g/L (3.5 lb/gal.) or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

PART 3 - EXECUTION

3.1 PREPARATION

A. Protect and maintain benchmarks and survey control points from disturbance during construction.

B. Locate and clearly identify trees, shrubs, and other vegetation to remain or to be relocated. Wrap a 1-inch (25-mm) blue vinyl tie tape flag around each tree trunk at 54 inches (1372 mm) above the ground.

C. Protect existing site improvements to remain from damage during construction.
   1. Restore damaged improvements to their original condition, as acceptable to Owner.

3.2 TEMPORARY EROSION AND SEDIMENTATION CONTROL

A. Provide temporary erosion and sedimentation control measures to prevent soil erosion and discharge of soil-bearing water runoff or airborne dust to adjacent properties and walkways, according to erosion- and sedimentation-control Drawings and requirements of authorities having jurisdiction.

B. Verify that flows of water redirected from construction areas or generated by construction activity do not enter or cross protection zones.

C. Inspect, maintain, and repair erosion- and sedimentation-control measures during construction until permanent vegetation has been established.

D. Remove erosion and sedimentation controls and restore and stabilize areas disturbed during removal.

3.3 TREE AND PLANT PROTECTION
A. Repair or replace trees, shrubs, and other vegetation indicated to remain or be relocated that are damaged by construction operations, in a manner approved by Engineer.

3.4 EXISTING UTILITIES

A. Owner will arrange for disconnecting and sealing indicated utilities that serve existing structures before site clearing, when requested by Contractor.
   1. Verify that utilities have been disconnected and capped before proceeding with site clearing.
B. Locate, identify, disconnect, and seal or cap utilities indicated to be removed or abandoned in place.
   1. Arrange with utility companies to shut off indicated utilities.
   2. Owner will arrange to shut off indicated utilities when requested by Contractor.
C. Locate, identify, and disconnect utilities indicated to be abandoned in place.
D. Interrupting Existing Utilities: Do not interrupt utilities serving facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary utility services according to requirements indicated:
   1. Notify Architect not less than 72 hours in advance of proposed utility interruptions.
   2. Do not proceed with utility interruptions without Architect's written permission.
E. Excavate for and remove underground utilities indicated to be removed.

3.5 CLEARING AND GRUBBING

A. Remove obstructions, trees, shrubs, and other vegetation to permit installation of new construction.
   1. Do not remove trees, shrubs, and other vegetation indicated to remain or to be relocated.
   2. Grind down stumps and remove roots, obstructions, and debris to a depth of [18 inches (450 mm)] below exposed subgrade.
   3. Chip removed tree branches and stockpile in areas approved by Architect.
B. Fill depressions caused by clearing and grubbing operations with satisfactory soil material unless further excavation or earthwork is indicated.
   1. Place fill material in horizontal layers not exceeding a loose depth of 8 inches (200 mm), and compact each layer to a density equal to adjacent original ground.

3.6 TOPSOIL STRIPPING

A. Remove sod and grass before stripping topsoil.
B. Strip topsoil to depth of 6 inches (150 mm) in a manner to prevent intermingling with underlying subsoil or other waste materials.
   1. Remove subsoil and nonsoil materials from topsoil, including clay lumps, gravel, and other objects more than 2 inches (50 mm) in diameter; trash, debris, weeds, roots, and other waste materials.
C.  Stockpile topsoil away from edge of excavations without intermixing with subsoil. Grade and shape stockpiles to drain surface water. Cover to prevent windblown dust and erosion by water.
  1.  Limit height of topsoil stockpiles to 72 inches (1800 mm).
  2.  Dispose of surplus topsoil. Surplus topsoil is that which exceeds quantity indicated to be stockpiled or reused.
  3.  Stockpile surplus topsoil to allow for re-spreading deeper topsoil.

3.7 SITE IMPROVEMENTS

A.  Remove existing above- and below-grade improvements as indicated and necessary to facilitate new construction.

B.  Remove slabs, paving, curbs, gutters, and aggregate base as indicated.
  1.  Unless existing full-depth joints coincide with line of demolition, neatly saw-cut along line of existing pavement to remain before removing adjacent existing pavement. Saw-cut faces vertically.
  2.  Paint cut ends of steel reinforcement in concrete to remain with two coats of antirust coating, following coating manufacturer's written instructions. Keep paint off surfaces that will remain exposed.

3.8 DISPOSAL OF SURPLUS AND WASTE MATERIALS

A.  Remove surplus soil material, unsuitable topsoil, obstructions, demolished materials, and waste materials including trash and debris, and legally dispose of them off Owner's property.

B.  Separate recyclable materials produced during site clearing from other non-recyclable materials. Store or stockpile without intermixing with other materials and transport them to recycling facilities. Do not interfere with other Project work.

END OF SECTION
PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:
   1. Preparing subgrades for slabs-on-grade, walks, and pavements.
   2. Excavating and backfilling for buildings and structures.
   3. Drainage course for concrete slabs-on-grade.
   4. Subbase course for concrete walks and pavements.
   5. Subbase course and base course for asphalt paving.
   6. Subsurface drainage backfill for walls and trenches.
   7. Excavating and backfilling trenches for utilities and pits for buried utility structures.
   8. Excavating well hole to accommodate elevator-cylinder assembly.

B. Related Sections:
   1. Division 01 Section "Temporary Facilities and Controls" for temporary controls, utilities, and support facilities; also for temporary site fencing if not in another Section.
   2. Division 03 Section "Cast-in-Place Concrete" for granular course if placed over vapor retarder and beneath the slab-on-grade.
   3. Division 2 Section "Site Clearing" for site stripping, grubbing, stripping [and stockpiling] topsoil, and removal of above- and below-grade improvements and utilities.

1.3 UNIT PRICES

A. Rock Measurement: Volume of rock actually removed, measured in original position, but not to exceed the following. Unit prices for rock excavation include replacement with approved materials.
   1. 24 inches (600 mm) outside of concrete forms other than at footings.
   2. 12 inches (300 mm) outside of concrete forms at footings.
   3. 6 inches (150 mm) outside of minimum required dimensions of concrete cast against grade.
   4. Outside dimensions of concrete walls indicated to be cast against rock without forms or exterior waterproofing treatments.
   5. 6 inches (150 mm) beneath bottom of concrete slabs-on-grade.
   6. 6 inches (150 mm) beneath pipe in trenches, and the greater of 24 inches (600 mm) wider than pipe or 42 inches (1065 mm) wide.

1.4 DEFINITIONS

A. Backfill: Soil material or controlled low-strength material used to fill an excavation.
   1. Initial Backfill: Backfill placed beside and over pipe in a trench, including haunches to support sides of pipe.
   2. Final Backfill: Backfill placed over initial backfill to fill a trench.
B. Base Course: Aggregate layer placed between the subbase course and hot-mix asphalt paving.
C. Bedding Course: Aggregate layer placed over the excavated subgrade in a trench before laying pipe.
D. Borrow Soil: Satisfactory soil imported from off-site for use as fill or backfill.
E. Drainage Course: Aggregate layer supporting the slab-on-grade that also minimizes upward capillary flow of pore water.
F. Excavation: Removal of material encountered above subgrade elevations and to lines and dimensions indicated.
   1. Authorized Additional Excavation: Excavation below subgrade elevations or beyond indicated lines and dimensions as directed by Architect. Authorized additional excavation and replacement material will be paid for according to Contract provisions for unit prices.
   2. Bulk Excavation: Excavation more than 10 feet (3 m) in width and more than 30 feet (9 m) in length.
   3. Unauthorized Excavation: Excavation below subgrade elevations or beyond indicated lines and dimensions without direction by Architect. Unauthorized excavation, as well as remedial work directed by Architect, shall be without additional compensation.
G. Fill: Soil materials used to raise existing grades.
H. Rock: Rock material in beds, ledges, unstratified masses, conglomerate deposits, and boulders of rock material that exceed 1 cu. yd. (0.76 cu. m) for bulk excavation or 3/4 cu. yd. (0.57 cu. M) for footing, trench, and pit excavation that cannot be removed by rock excavating equipment equivalent to the following in size and performance ratings, without systematic drilling, ram hammering, ripping, or blasting, when permitted:
   1. Excavation of Footings, Trenches, and Pits: Late-model, track-mounted hydraulic excavator; equipped with a 42-inch- (1065-mm-) wide, maximum, short-tip-radius rock bucket; rated at not less than 138-hp (103-kW) flywheel power with bucket-curling force of not less than 28,700 lbf (128 kN) and stick-crowd force of not less than 18,400 lbf (82 kN) with extra-long reach boom; measured according to SAE J-1179.
   2. Bulk Excavation: Late-model, track-mounted loader; rated at not less than 230-hp (172-kW) flywheel power and developing a minimum of 47,992-lbf (213.3-kN) breakout force with a general-purpose bare bucket; measured according to SAE J-732.
I. Rock: Rock material in beds, ledges, unstratified masses, conglomerate deposits, and boulders of rock material 3/4 cu. yd. (0.57 cu. m) or more in volume that exceed a standard penetration resistance of 100 blows/2 inches (97 blows/50 mm) when tested by a geotechnical testing agency, according to ASTM D 1586.
J. Structures: Buildings, footings, foundations, retaining walls, slabs, tanks, curbs, mechanical and electrical appurtenances, or other man-made stationary features constructed above or below the ground surface.
K. Subbase Course: Aggregate layer placed between the subgrade and base course for hot-mix asphalt pavement, or aggregate layer placed between the subgrade and a cement concrete pavement or a cement concrete or hot-mix asphalt walk.
L. Subgrade: Uppermost surface of an excavation or the top surface of a fill or backfill immediately below subbase, drainage fill, drainage course, or topsoil materials.
M. Utilities: On-site underground pipes, conduits, ducts, and cables, as well as underground services within buildings.
1.5 SUBMITTALS
A. Product Data: For each type of the following manufactured products required:
1. Geotextiles.
2. Controlled low-strength material, including design mixture.
3. Geofoam.
4. Warning tapes.

B. Samples for Verification: For the following products, in sizes indicated below:
   1. Geotextile: 12 by 12 inches (300 by 300 mm).
   2. Warning Tape: 12 inches (300 mm) long; of each color.

C. Qualification Data: For qualified testing agency.

D. Material Test Reports: For each on-site and borrow soil material proposed for fill and backfill as follows:
   1. Classification according to ASTM D 2487.
   2. Laboratory compaction curve according to ASTM D 698.

E. Pre-excavation Photographs or Videotape: Show existing conditions of adjoining construction and site improvements, including finish surfaces, that might be misconstrued as damage caused by earth moving operations. Submit before earth moving begins.

1.5 QUALITY ASSURANCE

A. Blasting: Comply with applicable requirements in NFPA 495, "Explosive Materials Code," and prepare a blasting plan reporting the following:
   1. Types of explosive and sizes of charge to be used in each area of rock removal, types of blasting mats, sequence of blasting operations, and procedures that will prevent damage to site improvements and structures on Project site and adjacent properties.
   2. Seismographic monitoring during blasting operations.

B. Seismic Survey Agency: An independent testing agency, acceptable to authorities having jurisdiction, experienced in seismic surveys and blasting procedures to perform the following services:
   1. Report types of explosive and sizes of charge to be used in each area of rock removal, types of blasting mats, sequence of blasting operations, and procedures that will prevent damage to site improvements and structures on Project site and adjacent properties.
   2. Seismographic monitoring during blasting operations.

C. Geotechnical Testing Agency Qualifications: Qualified according to ASTM E 329 and ASTM D 3740 for testing indicated.

D. Pre-excavation Conference: Conduct conference at 1686 Constitution Road, Atlanta, Georgia.

1.6 PROJECT CONDITIONS

A. Traffic: Minimize interference with adjoining roads, streets, walks, and other adjacent occupied or used facilities during earth moving operations.
   1. Do not close or obstruct streets, walks, or other adjacent occupied or used facilities without permission from Owner and authorities having jurisdiction.
   2. Provide alternate routes around closed or obstructed traffic ways if required by Owner or authorities having jurisdiction.

B. Improvements on Adjoining Property: Authority for performing earth moving indicated on property adjoining Owner's property will be obtained by Owner before award of Contract.
   1. Do not proceed with work on adjoining property until directed by Architect.

C. Utility Locator Service: Notify "Call Before You Dig" (811) for area where Project is located before
beginning earth moving operations.

D. Do not commence earth moving operations until temporary erosion- and sedimentation-control measures, specified in Division 2 Section "Site Clearing," and the Civil Plans are in place.

E. The following practices are prohibited within protection zones:
1. Storage of construction materials, debris, or excavated material.
2. Parking vehicles or equipment.
3. Foot traffic.
4. Erection of sheds or structures.
5. Impoundment of water.
6. Excavation or other digging unless otherwise indicated.
7. Attachment of signs to or wrapping materials around trees or plants unless otherwise indicated.

F. Do not direct vehicle or equipment exhaust towards protection zones.

G. Prohibit heat sources, flames, ignition sources, and smoking within or near protection zones.

PART 2 - PRODUCTS

2.1 SOIL MATERIALS

A. General: Provide borrow soil materials when sufficient satisfactory soil materials are not available from excavations.

B. Satisfactory Soils: Soil Classification Groups GW, GP, GM, SW, SP, and SM according to ASTM D 2487, or a combination of these groups; free of rock or gravel larger than 3 inches (75 mm) in any dimension, debris, waste, frozen materials, vegetation, and other deleterious matter. It is recommended that the services of a geotechnical engineer be retained to certify to the quality of the fill material.

C. Unsatisfactory Soils: Soil Classification Groups GC, SC, CL, ML, OL, CH, MH, OH, and PT according to ASTM D 2487, or a combination of these groups.
1. Unsatisfactory soils also include satisfactory soils not maintained within 2 percent of optimum moisture content at time of compaction.

D. Subbase Material: Naturally or artificially graded mixture of natural or crushed gravel, crushed stone, and natural or crushed sand; ASTM D 2940; with at least 90 percent passing a 1-1/2-inch (37.5-mm) sieve and not more than 12 percent passing a No. 200 (0.075-mm) sieve.

E. Base Course: Naturally or artificially graded mixture of natural or crushed gravel, crushed stone, and natural or crushed sand; ASTM D 2940; with at least 95 percent passing a 1-1/2-inch (37.5-mm) sieve and not more than 8 percent passing a No. 200 (0.075-mm) sieve.

F. Engineered Fill: Naturally or artificially graded mixture of natural or crushed gravel, crushed stone, and natural or crushed sand; ASTM D 2940; with at least 90 percent passing a 1-1/2-inch (37.5-mm) sieve and not more than 12 percent passing a No. 200 (0.075-mm) sieve.

G. Bedding Course: Naturally or artificially graded mixture of natural or crushed gravel, crushed stone, and natural or crushed sand; ASTM D 2940; except with 100 percent passing a 1-inch (25-mm) sieve and not more than 8 percent passing a No. 200 (0.075-mm) sieve.

H. Drainage Course: Narrowly graded mixture of washed crushed stone, or crushed or uncrushed gravel; ASTM D 448; coarse-aggregate grading Size 57; with 100 percent passing a 1-1/2-inch (37.5-mm) sieve and 0 to 5 percent passing a No. 8 (2.36-mm) sieve.

I. Filter Material: Narrowly graded mixture of natural or crushed gravel, or crushed stone and natural...
sand; ASTM D 448; coarse-aggregate grading Size 67; with 100 percent passing a 1-inch (25-mm) sieve and 0 to 5 percent passing a No. 4 (4.75-mm) sieve.

J. Sand: ASTM C 33; fine aggregate.

K. Impervious Fill: Clayey gravel and sand mixture capable of compacting to a dense state.

2.2 GEOTEXTILES

A. Subsurface Drainage Geotextile: Nonwoven needle-punched geotextile, manufactured for subsurface drainage applications, made from polyolefins or polyesters; with elongation greater than 50 percent; complying with AASHTO M 288 and the following, measured per test methods referenced:
   1. Survivability: Class 2; AASHTO M 288.
   2. Grab Tensile Strength: 157 lbf (700 N); ASTM D 4632.
   3. Sewn Seam Strength: 142 lbf (630 N); ASTM D 4632.
   4. Tear Strength: 56 lbf (250 N); ASTM D 4533.
   5. Puncture Strength: 56 lbf (250 N); ASTM D 4833.
   6. Apparent Opening Size: [No. 60 (0.250-mm) sieve, maximum; ASTM D 4751.
   7. Permittivity: 0.2 per second, minimum; ASTM D 4491.
   8. UV Stability: 50 percent after 500 hours’ exposure; ASTM D 4355.

B. Separation Geotextile: Woven geotextile fabric, manufactured for separation applications, made from polyolefins or polyesters; with elongation less than 50 percent; complying with AASHTO M 288 and the following, measured per test methods referenced:
   1. Survivability: Class 2; AASHTO M 288.
   2. Grab Tensile Strength: 247 lbf (1100 N); ASTM D 4632.
   3. Sewn Seam Strength: 222 lbf (990 N); ASTM D 4632.
   4. Tear Strength: 90 lbf (400 N); ASTM D 4533.
   5. Puncture Strength: 90 lbf (400 N); ASTM D 4833.
   6. Apparent Opening Size: No. 60 (0.250-mm) sieve, maximum; ASTM D 4751.
   7. Permittivity: 0.02 per second, minimum; ASTM D 4491.
   8. UV Stability: 50 percent after 500 hours’ exposure; ASTM D 4355.

2.3 ACCESSORIES

A. Warning Tape: Acid- and alkali-resistant, polyethylene film warning tape manufactured for marking and identifying underground utilities, 6 inches (150 mm) wide and 4 mils (0.1 mm) thick, continuously inscribed with a description of the utility; colored as follows:
   2. Yellow: Gas, oil, steam, and dangerous materials.
   3. Orange: Telephone and other communications.
   4. Blue: Water systems.
   5. Green: Sewer systems.

B. Detectable Warning Tape: Acid- and alkali-resistant, polyethylene film warning tape manufactured for marking and identifying underground utilities, a minimum of 6 inches (150 mm) wide and 4 mils (0.1 mm) thick, continuously inscribed with a description of the utility, with metallic core encased in a protective jacket for corrosion protection, detectable by metal detector when tape is buried up to 30 inches (750 mm) deep; colored as follows:
2. Yellow: Gas, oil, steam, and dangerous materials.
3. Orange: Telephone and other communications.
4. Blue: Water systems.
5. Green: Sewer systems.

PART 3 - EXECUTION

3.1 PREPARATION

A. Protect structures, utilities, sidewalks, pavements, and other facilities from damage caused by settlement, lateral movement, undermining, washout, and other hazards created by earth moving operations.
B. Protect and maintain erosion and sedimentation controls during earth moving operations.
C. Protect subgrades and foundation soils from freezing temperatures and frost. Remove temporary protection before placing subsequent materials.

3.2 DEWATERING

A. Prevent surface water and ground water from entering excavations, from ponding on prepared subgrades, and from flooding Project site and surrounding area.
B. Protect subgrades from softening, undermining, washout, and damage by rain or water accumulation.
   1. Reroute surface water runoff away from excavated areas. Do not allow water to accumulate in excavations. Do not use excavated trenches as temporary drainage ditches.

3.3 EXPLOSIVES

A. Explosives: Do not use explosives.

3.4 EXCAVATION, GENERAL

A. Unclassified Excavation: Excavate to subgrade elevations regardless of the character of surface and subsurface conditions encountered. Unclassified excavated materials may include rock, soil materials, and obstructions. No changes in the Contract Sum or the Contract Time will be authorized for rock excavation or removal of obstructions.
   1. If excavated materials intended for fill and backfill include unsatisfactory soil materials and rock, replace with satisfactory soil materials.
   2. Remove rock to lines and grades indicated to permit installation of permanent construction without exceeding the following dimensions:
      a. 24 inches (600 mm) outside of concrete forms other than at footings.
      b. 12 inches (300 mm) outside of concrete forms at footings.
      c. 6 inches (150 mm) outside of minimum required dimensions of concrete cast against grade.
      d. Outside dimensions of concrete walls indicated to be cast against rock without forms or exterior waterproofing treatments.
      e. 6 inches (150 mm) beneath bottom of concrete slabs-on-grade.
      f. 6 inches (150 mm) beneath pipe in trenches, and the greater of 24 inches (600 mm)
wider than pipe or 42 inches (1065 mm) wide.

B. Classified Excavation: Excavate to subgrade elevations. Material to be excavated will be classified as earth and rock. Do not excavate rock until it has been classified and cross sectioned by Architect. The Contract Sum will be adjusted for rock excavation according to unit prices included in the Contract Documents. Changes in the Contract Time may be authorized for rock excavation.

1. Earth excavation includes excavating pavements and obstructions visible on surface; underground structures, utilities, and other items indicated to be removed; together with soil, boulders, and other materials not classified as rock or unauthorized excavation.
   a. Intermittent drilling; blasting, if permitted; ram hammering; or ripping of material not classified as rock excavation is earth excavation.

2. Rock excavation includes removal and disposal of rock. Remove rock to lines and subgrade elevations indicated to permit installation of permanent construction without exceeding the following dimensions:
   a. 24 inches (600 mm) outside of concrete forms other than at footings.
   b. 12 inches (300 mm) outside of concrete forms at footings.
   c. 6 inches (150 mm) outside of minimum required dimensions of concrete cast against grade.
   d. Outside dimensions of concrete walls indicated to be cast against rock without forms or exterior waterproofing treatments.
   e. 6 inches (150 mm) beneath bottom of concrete slabs-on-grade.
   f. 6 inches (150 mm) beneath pipe in trenches, and the greater of 24 inches (600 mm) wider than pipe or 42 inches (1065 mm) wide.

3.5 EXCAVATION FOR STRUCTURES

A. Excavate to indicated elevations and dimensions within a tolerance of plus or minus 1 inch (25 mm). If applicable, extend excavations a sufficient distance from structures for placing and removing concrete formwork, for installing services and other construction, and for inspections.

1. Excavations for Footings and Foundations: Do not disturb bottom of excavation. Excavate by hand to final grade just before placing concrete reinforcement. Trim bottoms to required lines and grades to leave solid base to receive other work.

2. Pile Foundations: Stop excavations 6 to 12 inches (150 to 300 mm) above bottom of pile cap before piles are placed. After piles have been driven, remove loose and displaced material. Excavate to final grade, leaving solid base to receive concrete pile caps.

3. Excavation for Underground Tanks, Basins, and Mechanical or Electrical Utility Structures: Excavate to elevations and dimensions indicated within a tolerance of plus or minus 1 inch (25 mm). Do not disturb bottom of excavations intended as bearing surfaces.

B. Excavations at Edges of Tree- and Plant-Protection Zones:

1. Excavate by hand to indicated lines, cross sections, elevations, and subgrades. Use narrow-tine spading forks to comb soil and expose roots. Do not break, tear, or chop exposed roots. Do not use mechanical equipment that rips, tears, or pulls roots.

2. Cut and protect roots according to Dekalb County Recommendations.

3.6 EXCAVATION FOR WALKS AND PAVEMENTS

A. Excavate surfaces under walks and pavements to indicated lines, cross sections, elevations, and
subgrades.

3.7 EXCAVATION FOR UTILITY TRENCHES

A. Excavate trenches to indicated gradients, lines, depths, and elevations.
   1. Beyond building perimeter, excavate trenches to allow installation of top of pipe below frost line.

B. Excavate trenches to uniform widths to provide the following clearance on each side of pipe or conduit. Excavate trench walls vertically from trench bottom to 12 inches (300 mm) higher than top of pipe or conduit unless otherwise indicated.
   1. Clearance: 12 inches (300 mm) each side of pipe or conduit.

C. Trench Bottoms: Excavate and shape trench bottoms to provide uniform bearing and support of pipes and conduit. Shape subgrade to provide continuous support for bells, joints, and barrels of pipes and for joints, fittings, and bodies of conduits. Remove projecting stones and sharp objects along trench subgrade.
   1. For pipes and conduit less than 6 inches (150 mm) in nominal diameter, hand-excavate trench bottoms and support pipe and conduit on an undisturbed subgrade.
   2. For pipes and conduit 6 inches (150 mm) or larger in nominal diameter, shape bottom of trench to support bottom 90 degrees of pipe or conduit circumference. Fill depressions with tamped sand backfill.
   3. For flat-bottomed, multiple-duct conduit units, hand-excavate trench bottoms and support conduit on an undisturbed subgrade.
   4. Excavate trenches 6 inches (150 mm) deeper than elevation required in rock or other unyielding bearing material to allow for bedding course.

D. Trench Bottoms: Excavate trenches 4 inches (100 mm) deeper than bottom of pipe and conduit elevations to allow for bedding course. Hand-excavate deeper for bells of pipe.
   1. Excavate trenches 6 inches (150 mm) deeper than elevation required in rock or other unyielding bearing material to allow for bedding course.

E. Trenches in Tree- and Plant-Protection Zones:
   1. Hand-excavate to indicated lines, cross sections, elevations, and subgrades. Use narrow-tine spading forks to comb soil and expose roots. Do not break, tear, or chop exposed roots. Do not use mechanical equipment that rips, tears, or pulls roots.
   2. Do not cut main lateral roots or taproots; cut only smaller roots that interfere with installation of utilities.
   3. Cut and protect roots according to Dekalb County.

3.8 SUBGRADE INSPECTION

A. Notify Architect when excavations have reached required subgrade.

B. If Architect determines that unsatisfactory soil is present, continue excavation and replace with compacted backfill or fill material as directed.

C. Proof-roll subgrade below the building slabs and pavements with a pneumatic-tired and loaded 10-wheel, tandem-axle dump truck weighing not less than 15 tons (13.6 tonnes) to identify soft pockets and areas of excess yielding. Do not proof-roll wet or saturated subgrades.
   1. Completely proof-roll subgrade in one direction, repeating proof-rolling in direction perpendicular to first direction. Limit vehicle speed to 3 mph (5 km/h).
   2. Excavate soft spots, unsatisfactory soils, and areas of excessive pumping or rutting, as
Determined by Architect, and replace with compacted backfill or fill as directed.

D. Authorized additional excavation and replacement material will be paid for according to Contract provisions for unit prices.

E. Reconstruct subgrades damaged by freezing temperatures, frost, rain, accumulated water, or construction activities, as directed by Architect, without additional compensation.

3.9 UNAUTHORIZED EXCAVATION

A. Fill unauthorized excavation under foundations or wall footings by extending bottom elevation of concrete foundation or footing to excavation bottom, without altering top elevation. Lean concrete fill, with 28-day compressive strength of 2500 psi (17.2 MPa), may be used when approved by Architect.

1. Fill unauthorized excavations under other construction, pipe, or conduit as directed by Architect.

3.10 STORAGE OF SOIL MATERIALS

A. Stockpile borrow soil materials and excavated satisfactory soil materials without intermixing. Place, grade, and shape stockpiles to drain surface water. Cover to prevent windblown dust.

1. Stockpile soil materials away from edge of excavations. Do not store within drip line of remaining trees.

3.11 BACKFILL

A. Place and compact backfill in excavations promptly, but not before completing the following:

1. Construction below finish grade including, where applicable, subdrainage, dampproofing, waterproofing, and perimeter insulation.
2. Surveying locations of underground utilities for Record Documents.
3. Testing and inspecting underground utilities.
4. Removing concrete formwork.
5. Removing trash and debris.
6. Removing temporary shoring and bracing, and sheeting.
7. Installing permanent or temporary horizontal bracing on horizontally supported walls.

B. Place backfill on subgrades free of mud, frost, snow, or ice.

3.12 UTILITY TRENCH BACKFILL

A. Place backfill on subgrades free of mud, frost, snow, or ice.

B. Place and compact bedding course on trench bottoms and where indicated. Shape bedding course to provide continuous support for bells, joints, and barrels of pipes and for joints, fittings, and bodies of conduits.

C. Trenches under Footings: Backfill trenches excavated under footings and within 18 inches (450 mm) of bottom of footings with satisfactory soil; fill with concrete to elevation of bottom of footings. Concrete is specified in Division 03 Section “Cast-in-Place Concrete.”

D. Trenches under Roadways: Provide 4-inch- (100-mm-) thick, concrete-base slab support for piping or conduit less than 30 inches (750 mm) below surface of roadways. After installing and testing, completely encase piping or conduit in a minimum of 4 inches (100 mm) of concrete before...
backfilling or placing roadway subbase course. Concrete is specified in Division 03 Section "Cast-in-Place Concrete."

E. Backfill voids with satisfactory soil while removing shoring and bracing.

F. Place and compact initial backfill of subbase material, free of particles larger than 1 inch (25 mm) in any dimension, to a height of 12 inches (300 mm) over the pipe or conduit.
   1. Carefully compact initial backfill under pipe haunches and compact evenly up on both sides and along the full length of piping or conduit to avoid damage or displacement of piping or conduit. Coordinate backfilling with utilities testing.

G. Controlled Low-Strength Material: Place initial backfill of controlled low-strength material to a height of 12 inches (300 mm) over the pipe or conduit. Coordinate backfilling with utilities testing.

H. Place and compact final backfill of satisfactory soil to final subgrade elevation.

I. Controlled Low-Strength Material: Place final backfill of controlled low-strength material to final subgrade elevation.

J. Install warning tape directly above utilities, 12 inches (300 mm) below finished grade, except 6 inches (150 mm) below subgrade under pavements and slabs.

3.13 SOIL FILL

A. Plow, scarify, bench, or break up sloped surfaces steeper than 1 vertical to 4 horizontal so fill material will bond with existing material.

B. Place and compact fill material in layers to required elevations as follows:
   1. Under grass and planted areas, use satisfactory soil material.
   2. Under walks and pavements, use satisfactory soil material.
   3. Under steps and ramps, use engineered fill.
   4. Under building slabs, use engineered fill.
   5. Under footings and foundations, use engineered fill.

C. Place soil fill on subgrades free of mud, frost, snow, or ice.

3.14 SOIL MOISTURE CONTROL

A. Uniformly moisten or aerate subgrade and each subsequent fill or backfill soil layer before compaction to within 2 percent of optimum moisture content.
   1. Do not place backfill or fill soil material on surfaces that are muddy, frozen, or contain frost or ice.
   2. Remove and replace, or scarify and air dry, otherwise satisfactory soil material that exceeds optimum moisture content by 2 percent and is too wet to compact to specified dry unit weight.

3.15 COMPACtion of SOIL backfills and fills

A. Place backfill and fill soil materials in layers not more than [8 inches (200 mm)] in loose depth for material compacted by heavy compaction equipment, and not more than 4 inches (100 mm) in loose depth for material compacted by hand-operated tampers.

B. Place backfill and fill soil materials evenly on all sides of structures to required elevations, and uniformly along the full length of each structure.

C. Compact soil materials to not less than the following percentages of maximum dry unit weight according to ASTM D 698:
   1. Under structures, building slabs, steps, and pavements, scarify and recompress top 12 inches
(300 mm) of existing subgrade and each layer of backfill or fill soil material at 98 percent.

2. Under walkways, scarify and recompact top 6 inches (150 mm) below subgrade and compact each layer of backfill or fill soil material at 95 percent.

3. Under turf or unpaved areas, scarify and recompact top 6 inches (150 mm) below subgrade and compact each layer of backfill or fill soil material at 85 percent.

4. For utility trenches, compact each layer of initial and final backfill soil material at 90 percent.

3.16 GRADING

A. General: Uniformly grade areas to a smooth surface, free of irregular surface changes. Comply with compaction requirements and grade to cross sections, lines, and elevations indicated.
   1. Provide a smooth transition between adjacent existing grades and new grades.
   2. Cut out soft spots, fill low spots, and trim high spots to comply with required surface tolerances.

B. Site Rough Grading: Slope grades to direct water away from buildings and to prevent ponding.
   Finish subgrades to required elevations within the following tolerances:
   1. Turf or Unpaved Areas: Plus or minus 1 inch (25 mm).
   2. Walks: Plus or minus 1 inch (25 mm).
   3. Pavements: Plus or minus 1/2 inch (13 mm).

C. Grading inside Building Lines: Finish subgrade to a tolerance of 1/2 inch (13 mm) when tested with a 10-foot (3-m) straightedge.

D. Drainage Backfill: Place and compact filter material over subsurface drain, in width indicated, to within 12 inches (300 mm) of final subgrade, in compacted layers 6 inches (150 mm) thick. Overlay drainage backfill with one layer of subsurface drainage geotextile, overlapping sides and ends at least 6 inches (150 mm).
   1. Compact each filter material layer to 90 percent of maximum dry unit weight according to ASTM D 698.
   2. Place and compact impervious fill over drainage backfill in 6-inch- (150-mm-) thick compacted layers to final subgrade.

3.17 SUBBASE AND BASE COURSES UNDER PAVEMENTS AND WALKS

A. Place subbase course and base course on subgrades free of mud, frost, snow, or ice.

B. On prepared subgrade, place subbase course and base course under pavements and walks as follows:
   1. Install separation geotextile on prepared subgrade according to manufacturer's written instructions, overlapping sides and ends.
   2. Place base course material over subbase course under hot-mix asphalt pavement.
   3. Shape subbase course and base course to required crown elevations and cross-slope grades.
   4. Place subbase course and base course 6 inches (150 mm) or less in compacted thickness in a single layer.
   5. Place subbase course and base course that exceeds 6 inches (150 mm) in compacted thickness in layers of equal thickness, with no compacted layer more than 6 inches (150 mm) thick or less than 3 inches (75 mm) thick.
   6. Compact subbase course and base course at optimum moisture content to required grades, lines, cross sections, and thickness to not less than 98 percent of maximum dry unit weight.
according to ASTM D 698.

3.18 DRAINAGE COURSE UNDER CONCRETE SLABS-ON-GRADE

A. Place drainage course on subgrades free of mud, frost, snow, or ice.
B. On prepared subgrade, place and compact drainage course under cast-in-place concrete slabs-on-grade as follows:
   1. Install subdrainage geotextile on prepared subgrade according to manufacturer’s written instructions, overlapping sides and ends.
   2. Place drainage course 6 inches (150 mm) or less in compacted thickness in a single layer.
   3. Place drainage course that exceeds 6 inches (150 mm) in compacted thickness in layers of equal thickness, with no compacted layer more than 6 inches (150 mm) thick or less than 3 inches (75 mm) thick.
   4. Compact each layer of drainage course to required cross sections and thicknesses to not less than 98 percent of maximum dry unit weight according to ASTM D 698.

3.19 FIELD QUALITY CONTROL

A. Special Inspections: Owner will engage a qualified special inspector to perform the following special inspections:
   1. Determine prior to placement of fill that site has been prepared in compliance with requirements.
   2. Determine that fill material and maximum lift thickness comply with requirements.
   3. Determine, at the required frequency, that in-place density of compacted fill complies with requirements.
B. Testing Agency: Owner will engage a qualified geotechnical engineering testing agency to perform tests and inspections.
C. Allow testing agency to inspect and test subgrades and each fill or backfill layer. Proceed with subsequent earth moving only after test results for previously completed work comply with requirements.
D. Footing Subgrade: At footing subgrades, at least one test of each soil stratum will be performed to verify design bearing capacities. Subsequent verification and approval of other footing subgrades may be based on a visual comparison of subgrade with tested subgrade when approved by Architect.
E. Testing agency will test compaction of soils in place according to ASTM D 1556, ASTM D 2167, ASTM D 2922, and ASTM D 2937, as applicable. Tests will be performed at the following locations and frequencies:
   1. Paved and Building Slab Areas: At subgrade and at each compacted fill and backfill layer, at least one test for every 2000 sq. ft. (186 sq. m) or less of paved area or building slab, but in no case fewer than three tests.
   2. Foundation Wall Backfill: At each compacted backfill layer, at least one test for every 100 feet (30 m) or less of wall length, but no fewer than two tests.
   3. Trench Backfill: At each compacted initial and final backfill layer, at least one test for every 150 feet (46 m) or less of trench length, but no fewer than two tests.
F. When testing agency reports that subgrades, fills, or backfills have not achieved degree of compaction specified, scarify and moisten or aerate, or remove and replace soil materials to depth required; recompact and retest until specified compaction is obtained.
3.20 PROTECTION

A. Protecting Graded Areas: Protect newly graded areas from traffic, freezing, and erosion. Keep free of trash and debris.

B. Repair and reestablish grades to specified tolerances where completed or partially completed surfaces become eroded, rutted, settled, or where they lose compaction due to subsequent construction operations or weather conditions.
   1. Scarify or remove and replace soil material to depth as directed by Architect; reshape and recompact.

C. Where settling occurs before Project correction period elapses, remove finished surfacing, backfill with additional soil material, compact, and reconstruct surfacing.
   1. Restore appearance, quality, and condition of finished surfacing to match adjacent work, and eliminate evidence of restoration to greatest extent possible.

3.21 DISPOSAL OF SURPLUS AND WASTE MATERIALS

A. Remove surplus satisfactory soil and waste materials, including unsatisfactory soil, trash, and debris, and legally dispose of them off Owner's property.

B. Transport surplus satisfactory soil to designated storage areas on Owner's property. Stockpile or spread soil as directed by Architect.
   1. Remove waste materials, including unsatisfactory soil, trash, and debris, and legally dispose of them off Owner's property.

END OF SECTION
PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section includes construction dewatering.
B. Related Sections:
   1. Division 2 Section "Earth Moving" for excavating, backfilling, site grading, and for site utilities.

1.3 PERFORMANCE REQUIREMENTS

A. Dewatering Performance: Design, furnish, install, test, operate, monitor, and maintain dewatering system of sufficient scope, size, and capacity to control hydrostatic pressures and to lower, control, remove, and dispose of ground water and permit excavation and construction to proceed on dry, stable subgrades.
   1. Delegated Design: Design dewatering system, including comprehensive engineering analysis by a qualified professional engineer, using performance requirements and design criteria indicated.
   2. Continuously monitor and maintain dewatering operations to ensure erosion control, stability of excavations and constructed slopes, that excavation does not flood, and that damage to subgrades and permanent structures is prevented.
   3. Prevent surface water from entering excavations by grading, dikes, or other means.
   4. Accomplish dewatering without damaging existing buildings, structures, and site improvements adjacent to excavation.
   5. Remove dewatering system when no longer required for construction.

1.4 SUBMITTALS

A. Shop Drawings: For dewatering system. Show arrangement, locations, and details of wells and well points; locations of risers, headers, filters, pumps, power units, and discharge lines; and means of discharge, control of sediment, and disposal of water.
   1. Include layouts of piezometers and flow-measuring devices for monitoring performance of dewatering system.
   2. Include a written plan for dewatering operations including control procedures to be adopted if dewatering problems arise.
B. Delegated-Design Submittal: For dewatering system indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.
C. Qualification Data: For qualified Installer.
D. Field quality-control reports.
E. Other Informational Submittals:
   1. Photographs: Show existing conditions of adjoining construction and site improvements that might be misconstrued as damage caused by dewatering operations.

1.4 QUALITY ASSURANCE

A. Installer Qualifications: An experienced installer that has specialized in design of dewatering systems and dewatering work.
B. Regulatory Requirements: Comply with governing EPA notification regulations before beginning dewatering. Comply with hauling and disposal regulations of authorities having jurisdiction.

1.5 PROJECT CONDITIONS

A. Survey Work: Engage a qualified land surveyor or professional engineer to survey adjacent existing buildings, structures, and site improvements, establishing exact elevations at fixed points to act as benchmarks. Clearly identify benchmarks and record existing elevations.
   1. During dewatering, regularly resurvey benchmarks, maintaining an accurate log of surveyed elevations for comparison with original elevations. Promptly notify Architect if changes in elevations occur or if cracks, sags, or other damage is evident in adjacent construction.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION

3.1 PREPARATION
A. Protect structures, utilities, sidewalks, pavements, and other facilities from damage caused by settlement, lateral movement, undermining, washout, and other hazards created by dewatering operations.
   1. Prevent surface water and subsurface or ground water from entering excavations, from ponding on prepared subgrades, and from flooding site and surrounding area.
   2. Protect subgrades and foundation soils from softening and damage by rain or water accumulation.
B. Install dewatering system to ensure minimum interference with roads, streets, walks, and other adjacent occupied and used facilities.
   1. Do not close or obstruct streets, walks, or other adjacent occupied or used facilities without permission from Owner and authorities having jurisdiction. Provide alternate routes around closed or obstructed traffic ways if required by authorities having jurisdiction.
C. Provide temporary grading to facilitate dewatering and control of surface water.
D. Monitor dewatering systems continuously.
E. Promptly repair damages to adjacent facilities caused by dewatering.
F. Protect and maintain temporary erosion and sedimentation controls, which are specified in Division 2 Section “Site Clearing” and in the approved Civil plans during dewatering operations.

3.2 INSTALLATION
A. Install dewatering system utilizing wells, well points, or similar methods complete with pump equipment, standby power and pumps, filter material gradation, valves, appurtenances, water
disposal, and surface-water controls.
1. Space well points or wells at intervals required to provide sufficient dewatering.
2. Use filters or other means to prevent pumping of fine sands or silts from the subsurface.

B. Before excavating below ground-water level, place system into operation to lower water to specified levels. Operate system continuously until drains, sewers, and structures have been constructed and fill materials have been placed or until dewatering is no longer required.

C. Provide an adequate system to lower and control ground water to permit excavation, construction of structures, and placement of fill materials on dry subgrades. Install sufficient dewatering equipment to drain water-bearing strata above and below bottom of foundations, drains, sewers, and other excavations.
1. Do not permit open-sump pumping that leads to loss of fines, soil piping, subgrade softening, and slope instability.

D. Reduce hydrostatic head in water-bearing strata below subgrade elevations of foundations, drains, sewers, and other excavations.
1. Maintain piezometric water level a minimum of 60 inches (1500 mm) below surface of excavation.

E. Dispose of water removed by dewatering in a manner that avoids endangering public health, property, and portions of work under construction or completed. Dispose of water and sediment in a manner that avoids inconvenience to others. Provide sumps, sedimentation tanks, and other flow-control devices as required by authorities having jurisdiction.

F. Provide standby equipment on site, installed and available for immediate operation, to maintain dewatering on continuous basis if any part of system becomes inadequate or fails. If dewatering requirements are not satisfied due to inadequacy or failure of dewatering system, restore damaged structures and foundation soils at no additional expense to Owner.
1. Remove dewatering system from Project site on completion of dewatering. Plug or fill well holes with sand or cut off and cap wells a minimum of 36 inches (900 mm) below overlying construction.

G. Damages: Promptly repair damages to adjacent facilities caused by dewatering operations.

3.3 FIELD QUALITY CONTROL

A. Observation Wells: Provide, take measurements, and maintain at least the minimum number of observation wells or piezometers indicated; additional observation wells may be required by authorities having jurisdiction.
1. Observe and record daily elevation of ground water and piezometric water levels in observation wells.
2. Repair or replace, within 24 hours, observation wells that become inactive, damaged, or destroyed. In areas where observation wells are not functioning properly, suspend construction activities until reliable observations can be made. Add or remove water from observation-well risers to demonstrate that observation wells are functioning properly.
3. Fill observation wells, remove piezometers, and fill holes when dewatering is completed.

B. Provide continual observation to ensure that subsurface soils are not being removed by the dewatering operation.
PART 1 - GENERAL

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

1.2 SUMMARY
A. Section Includes:
   1. Cold milling of existing hot-mix asphalt pavement.
   2. Hot-mix asphalt patching.
   3. Hot-mix asphalt paving.
   4. Hot-mix asphalt paving overlay.
   5. Asphalt surface treatments.
   8. Imprinted asphalt.

B. Related Sections:
   1. Division 02 Section "Structure Demolition" for demolition, removal, and recycling of existing asphalt pavements, and for geotextiles that are not embedded within courses of asphalt paving.
   2. Division 2 Section "Earth Moving" for aggregate subbase and base courses and for aggregate pavement shoulders.
   3. Division 3 Section "Concrete Paving Joint Sealants" for joint sealants and fillers at paving terminations.

1.3 UNIT PRICES
A. Work of this Section is affected by unit price.

1.4 DEFINITION
A. Hot-Mix Asphalt Paving Terminology: Refer to ASTM D 8 for definitions of terms.

1.5 SUBMITTALS
A. Product Data: For each type of product indicated. Include technical data and tested physical and performance properties.
   1. Job-Mix Designs: Certification, by authorities having jurisdiction, of approval of each job mix proposed for the Work.
   2. Job-Mix Designs: For each job mix proposed for the Work.

B. Shop Drawings: Indicate pavement markings, lane separations, and defined parking spaces. Indicate, with international symbol of accessibility, spaces allocated for people with disabilities.
C. Samples: For each paving fabric, 12 by 12 inches (300 by 300 mm) minimum.

D. Samples for Verification: For the following products, in manufacturer's standard sizes unless otherwise indicated:
   1. Each paving fabric, 12 by 12 inches (300 by 300 mm) minimum.
   2. Each type and color of preformed traffic-calming device.

E. Qualification Data: For qualified manufacturer and Installer.

F. Material Certificates: For each paving material, from manufacturer.

G. Material Test Reports: For each paving material.

1.6 QUALITY ASSURANCE

A. Manufacturer Qualifications: A paving-mix manufacturer registered with and approved by authorities having jurisdiction.

B. Installer Qualifications: Imprinted-asphalt manufacturer's authorized installer who is trained and approved for installation of imprinted asphalt required for this Project.

C. Testing Agency Qualifications: Qualified according to ASTM D 3666 for testing indicated.

D. Regulatory Requirements: Comply with materials, workmanship, and other applicable requirements of Clayton County for asphalt paving work.
   1. Measurement and payment provisions and safety program submittals included in standard specifications do not apply to this Section.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Deliver pavement-marking materials to Project site in original packages with seals unbroken and bearing manufacturer's labels containing brand name and type of material, date of manufacture, and directions for storage.

B. Store pavement-marking materials in a clean, dry, protected location within temperature range required by manufacturer. Protect stored materials from direct sunlight.

1.8 PROJECT CONDITIONS

A. Environmental Limitations: Do not apply asphalt materials if subgrade is wet or excessively damp, if rain is imminent or expected before time required for adequate cure, or if the following conditions are not met:
   1. Prime Coat: Minimum surface temperature of 60 deg F (15.6 deg C).
   2. Tack Coat: Minimum surface temperature of 60 deg F (15.6 deg C).
   4. Asphalt Base Course: Minimum surface temperature of 40 deg F (4.4 deg C) and rising at time of placement.
   5. Asphalt Surface Course: Minimum surface temperature of 60 deg F (15.6 deg C) at time of placement.
B. Pavement-Marking Paint: Proceed with pavement marking only on clean, dry surfaces and at a minimum ambient or surface temperature of 55 deg F (12.8 deg C) for water-based materials, and not exceeding 95 deg F (35 deg C).

C. Imprinted Asphalt Paving: Proceed with coating imprinted pavement only when air temperature is at least 50 deg F (10 deg C) and rising and will not drop below 50 deg F (10 deg C) within 8 hours of coating application. Proceed only if no precipitation is expected within two hours after applying the final layer of coating.

PART 2 - PRODUCTS

2.1 AGGREGATES

A. General: Use materials and gradations that have performed satisfactorily in previous installations.

B. Coarse Aggregate: ASTM D 692, sound; angular crushed stone, crushed gravel, or cured, crushed blast-furnace slag.

C. Fine Aggregate: ASTM D 1073, sharp-edged natural sand or sand prepared from stone, gravel, cured blast-furnace slag, or combinations thereof.

1. For hot-mix asphalt, limit natural sand to a maximum of 20 percent by weight of the total aggregate mass.

D. Mineral Filler: ASTM D 242 or AASHTO M 17, rock or slag dust, hydraulic cement, or other inert material.

2.2 ASPHALT MATERIALS

A. Asphalt Binder: AASHTO M 320.

B. Asphalt Cement: ASTM D 3381 for viscosity-graded material.

C. Prime Coat: ASTM D 2027, medium-curing cutback asphalt.

D. Prime Coat: Asphalt emulsion prime coat complying with Dekalb Roads Department requirements and the Georgia Department of Transportation.

E. Tack Coat: ASTM D 977 or AASHTO M 140 emulsified asphalt, or ASTM D 2397 or AASHTO M 208 cationic emulsified asphalt, slow setting, diluted in water, of suitable grade and consistency for application.

F. Fog Seal: ASTM D 977 or AASHTO M 140 emulsified asphalt, or ASTM D 2397 or AASHTO M 208 cationic emulsified asphalt, slow setting, factory diluted in water, of suitable grade and consistency for application.

G. Water: Potable.

H. Undersealing Asphalt: ASTM D 3141, pumping consistency.

2.3 AUXILIARY MATERIALS
A. Herbicide: Commercial chemical for weed control, registered by the EPA. Provide in granular, liquid, or wettable powder form.

B. Sand: ASTM D 1073 or AASHTO M 29, Grade Nos. 2 or 3.

C. Paving Geotextile: AASHTO M 288, nonwoven polypropylene; resistant to chemical attack, rot, and mildew; and specifically designed for paving applications.


E. Pavement-Marking Paint: Alkyd-resin type, lead and chromate free, ready mixed, complying with AASHTO M 248; colors complying with FS TT-P-1952.
   1. Color: White

F. Wheel Stops: Precast, air-entrained concrete, 2500-psi (17.2-MPa) minimum compressive strength, [4-1/2 inches (115 mm) high by 9 inches (225 mm) wide by 72 inches (1800 mm) . Provide chamfered corners, drainage slots on underside, and holes for anchoring to substrate.
   1. Dowels: Galvanized steel, 3/4-inch (19-mm) diameter, 10-inch (254-mm) minimum length.

2.4 MIXES

A. Hot-Mix Asphalt: Dense, hot-laid, hot-mix asphalt plant mixes approved by authorities having jurisdiction designed according to procedures in AIME-2, "Mix Design Methods for Asphalt Concrete and Other Hot-Mix Types" and complying with the following requirements:
   1. Provide mixes with a history of satisfactory performance in geographical area where Project is located.
   2. Base Course: Georgia D.O.T. Base – Section 310
   3. Wear Course: Georgia D.O.T. Wear Course – Section 400 – Type H

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify that subgrade is dry and in suitable condition to begin paving.

B. Proof-roll subgrade below pavements with heavy pneumatic-tired equipment to identify soft pockets and areas of excess yielding. Do not proof-roll wet or saturated subgrades.
   1. Completely proof-roll subgrade in one direction repeating proof-rolling in direction perpendicular to first direction. Limit vehicle speed to 3 mph (5 km/h).
   2. Proof roll with a loaded 10-wheel, tandem-axle dump truck weighing not less than 15 tons (13.6 tonnes).
   3. Excavate soft spots, unsatisfactory soils, and areas of excessive pumping or rutting, as determined by Architect, and replace with compacted backfill or fill as directed.

C. Proceed with paving only after unsatisfactory conditions have been corrected.

D. Verify that utilities, traffic loop detectors, and other items requiring a cut and installation beneath the asphalt surface have been completed and that asphalt surface has been repaired flush with adjacent asphalt prior to beginning installation of imprinted asphalt.
3.2 PATCHING

A. Hot-Mix Asphalt Pavement: Saw cut perimeter of patch and excavate existing pavement section to sound base. Excavate rectangular or trapezoidal patches, extending 12 inches (300 mm) into adjacent sound pavement, unless otherwise indicated. Cut excavation faces vertically. Remove excavated material. Recompact existing unbound-aggregate base course to form new subgrade.

B. Portland Cement Concrete Pavement: Break cracked slabs and roll as required to reseat concrete pieces firmly.
   1. Pump hot undersealing asphalt under rocking slab until slab is stabilized or, if necessary, crack slab into pieces and roll to reseat pieces firmly.
   2. Remove disintegrated or badly cracked pavement. Excavate rectangular or trapezoidal patches, extending into adjacent sound pavement, unless otherwise indicated. Cut excavation faces vertically. Recompact existing unbound-aggregate base course to form new subgrade.

C. Tack Coat: Apply uniformly to vertical surfaces abutting or projecting into new, hot-mix asphalt paving at a rate of 0.05 to 0.15 gal./sq. yd. (0.2 to 0.7 L/sq. m).
   1. Allow tack coat to cure undisturbed before applying hot-mix asphalt paving.
   2. Avoid smearing or staining adjoining surfaces, appurtenances, and surroundings. Remove spillages and clean affected surfaces.

D. Patching: Fill excavated pavements with hot-mix asphalt base mix for full thickness of patch and, while still hot, compact flush with adjacent surface.

E. Patching: Partially fill excavated pavements with hot-mix asphalt base mix and, while still hot, compact. Cover asphalt base course with compacted, hot-mix surface layer finished flush with adjacent surfaces.

3.3 REPAIRS

A. Leveling Course: Install and compact leveling course consisting of hot-mix asphalt surface course to level sags and fill depressions deeper than 1 inch (25 mm) in existing pavements.
   1. Install leveling wedges in compacted lifts not exceeding 3 inches (75 mm) thick.

B. Crack and Joint Filling: Remove existing joint filler material from cracks or joints to a depth of 1/4 inch (6 mm).
   1. Clean cracks and joints in existing hot-mix asphalt pavement.
   2. Use emulsified-asphalt slurry to seal cracks and joints less than 1/4 inch (6 mm) wide. Fill flush with surface of existing pavement and remove excess.
   3. Use hot-applied joint sealant to seal cracks and joints more than 1/4 inch (6 mm) wide. Fill flush with surface of existing pavement and remove excess.

3.4 SURFACE PREPARATION

A. General: Immediately before placing asphalt materials, remove loose and deleterious material from substrate surfaces. Ensure that prepared subgrade is ready to receive paving.
B. Herbicide Treatment: Apply herbicide according to manufacturer's recommended rates and written application instructions. Apply to dry, prepared subgrade or surface of compacted-aggregate base before applying paving materials.

1. Mix herbicide with prime coat if formulated by manufacturer for that purpose.

C. Prime Coat: Apply uniformly over surface of compacted unbound-aggregate base course at a rate of 0.15 to 0.50 gal./sq. yd. (0.7 to 2.3 L/sq. m). Apply enough material to penetrate and seal but not flood surface. Allow prime coat to cure.

1. If prime coat is not entirely absorbed within 24 hours after application, spread sand over surface to blot excess asphalt. Use enough sand to prevent pickup under traffic. Remove loose sand by sweeping before pavement is placed and after volatiles have evaporated.
2. Protect primed substrate from damage until ready to receive paving.

D. Tack Coat: Apply uniformly to surfaces of existing pavement at a rate of 0.05 to 0.15 gal./sq. yd. (0.2 to 0.7 L/sq. m).

1. Allow tack coat to cure undisturbed before applying hot-mix asphalt paving.
2. Avoid smearing or staining adjoining surfaces, appurtenances, and surroundings. Remove spillages and clean affected surfaces.

3.5 HOT-MIX ASPHALT PLACING

A. Machine place hot-mix asphalt on prepared surface, spread uniformly, and strike off. Place asphalt mix by hand to areas inaccessible to equipment in a manner that prevents segregation of mix. Place each course to required grade, cross section, and thickness when compacted.

1. Place hot-mix asphalt base course in number of lifts and thicknesses indicated.
2. Place hot-mix asphalt surface course in single lift.
3. Spread mix at minimum temperature of 250 deg F (121 deg C).
4. Begin applying mix along centerline of crown for crowned sections and on high side of one-way slopes unless otherwise indicated.
5. Regulate paver machine speed to obtain smooth, continuous surface free of pulls and tears in asphalt-paving mat.

B. Place paving in consecutive strips not less than 10 feet (3 m) wide unless infill edge strips of a lesser width are required.

1. After first strip has been placed and rolled, place succeeding strips and extend rolling to overlap previous strips. Complete a section of asphalt base course before placing asphalt surface course.

C. Promptly correct surface irregularities in paving course behind paver. Use suitable hand tools to remove excess material forming high spots. Fill depressions with hot-mix asphalt to prevent segregation of mix; use suitable hand tools to smooth surface.

3.6 JOINTS

A. Construct joints to ensure a continuous bond between adjoining paving sections. Construct joints free of depressions, with same texture and smoothness as other sections of hot-mix asphalt course.

1. Clean contact surfaces and apply tack coat to joints.
2. Offset longitudinal joints, in successive courses, a minimum of 6 inches (150 mm).
3. Offset transverse joints, in successive courses, a minimum of 24 inches (600 mm).
4. Construct transverse joints at each point where paver ends a day's work and resumes work at a subsequent time. Construct these joints using either "bulkhead" or "papered" method according to AI MS-22, for both "Ending a Lane" and "Resumption of Paving Operations." Compact joints as soon as hot-mix asphalt will bear roller weight without excessive displacement.
5. Compact asphalt at joints to a density within 2 percent of specified course density.

3.7 COMPACTION

A. General: Begin compaction as soon as placed hot-mix paving will bear roller weight without excessive displacement. Compact hot-mix paving with hot, hand tampers or with vibratory-plate compactors in areas inaccessible to rollers.

1. Complete compaction before mix temperature cools to 185 deg F (85 deg C).

B. Breakdown Rolling: Complete breakdown or initial rolling immediately after rolling joints and outside edge. Examine surface immediately after breakdown rolling for indicated crown, grade, and smoothness. Correct laydown and rolling operations to comply with requirements.

C. Intermediate Rolling: Begin intermediate rolling immediately after breakdown rolling while hot-mix asphalt is still hot enough to achieve specified density. Continue rolling until hot-mix asphalt course has been uniformly compacted to the following density:

1. Average Density: 96 percent of reference laboratory density according to ASTM D 6927, but not less than 94 percent nor greater than 100 percent.
2. Average Density: 92 percent of reference maximum theoretical density according to ASTM D 2041, but not less than 90 percent nor greater than 96 percent.

D. Finish Rolling: Finish roll paved surfaces to remove roller marks while hot-mix asphalt is still warm.

E. Edge Shaping: While surface is being compacted and finished, trim edges of pavement to proper alignment. Bevel edges while asphalt is still hot; compact thoroughly.

F. Repairs: Remove paved areas that are defective or contaminated with foreign materials and replace with fresh, hot-mix asphalt. Compact by rolling to specified density and surface smoothness.

G. Protection: After final rolling, do not permit vehicular traffic on pavement until it has cooled and hardened.

H. Erect barricades to protect paving from traffic until mixture has cooled enough not to become marked.

3.8 ASPHALT CURBS

A. Construct hot-mix asphalt curbs over compacted pavement surfaces. Apply a light tack coat unless pavement surface is still tacky and free from dust. Spread mix at minimum temperature of 250 deg F (121 deg C).

1. Asphalt Mix: Same as pavement surface-course mix.
B. Place hot-mix asphalt to curb cross section indicated or, if not indicated, to local standard shapes, by machine or by hand in wood or metal forms. Tamp hand-placed materials and screed to smooth finish. Remove forms after hot-mix asphalt has cooled.

3.9 INSTALLATION TOLERANCES

A. Pavement Thickness: Compact each course to produce the thickness indicated within the following tolerances:

1. Base Course: Plus or minus 1/2 inch (13 mm).
2. Surface Course: Plus 1/4 inch (6 mm), no minus.

B. Pavement Surface Smoothness: Compact each course to produce a surface smoothness within the following tolerances as determined by using a 10-foot (3-m) straightedge applied transversely or longitudinally to paved areas:

1. Base Course: 1/4 inch (6 mm)
2. Surface Course: 1/8 inch (3 mm)
3. Crowned Surfaces: Test with crowned template centered and at right angle to crown. Maximum allowable variance from template is 1/4 inch (6 mm).

3.10 SURFACE TREATMENTS

A. Fog Seals: Apply fog seal at a rate of 0.10 to 0.15 gal./sq. yd. (0.45 to 0.7 L/sq. m) to existing asphalt pavement and allow to cure. With fine sand, lightly dust areas receiving excess fog seal.

B. Slurry Seals: Apply slurry coat in a uniform thickness according to ASTM D 3910 and allow to cure.

1. Roll slurry seal to remove ridges and provide a uniform, smooth surface.

3.11 PAVEMENT MARKING

A. Do not apply pavement-marking paint until layout, colors, and placement have been verified with Architect.

B. Allow paving to age for 30 days before starting pavement marking.

C. Sweep and clean surface to eliminate loose material and dust.

D. Apply paint with mechanical equipment to produce pavement markings, of dimensions indicated, with uniform, straight edges. Apply at manufacturer's recommended rates to provide a minimum wet film thickness of 15 mils (0.4 mm).

1. Broadcast glass beads uniformly into wet pavement markings at a rate of 6 lb/gal. (0.72 kg/L).

3.12 WHEEL STOPS

A. Install wheel stops in bed of adhesive as recommended by manufacturer.
B. Securely attach wheel stops to pavement with not less than two galvanized-steel dowels embedded at one-quarter to one-third points. Securely install dowels into pavement and bond to wheel stop. Recess head of dowel beneath top of wheel stop.

3.13 FIELD QUALITY CONTROL

A. Testing Agency: Engage a qualified testing agency to perform tests and inspections.

B. Thickness: In-place compacted thickness of hot-mix asphalt courses will be determined according to ASTM D 3549.

C. Surface Smoothness: Finished surface of each hot-mix asphalt course will be tested for compliance with smoothness tolerances.

D. In-Place Density: Testing agency will take samples of uncompacted paving mixtures and compacted pavement according to ASTM D 979.

1. Reference maximum theoretical density will be determined by averaging results from four samples of hot-mix asphalt-paving mixture delivered daily to site, prepared according to ASTM D 2041, and compacted according to job-mix specifications.

2. In-place density of compacted pavement will be determined by testing core samples according to ASTM D 1188 or ASTM D 2726.

   a. One core sample will be taken for every 1000 sq. yd. (836 sq. m) or less of installed pavement, with no fewer than 3 cores taken.

   b. Field density of in-place compacted pavement may also be determined by nuclear method according to ASTM D 2950 and correlated with ASTM D 1188 or ASTM D 2726.

E. Replace and compact hot-mix asphalt where core tests were taken.

F. Remove and replace or install additional hot-mix asphalt where test results or measurements indicate that it does not comply with specified requirements.

3.14 DISPOSAL

A. Except for material indicated to be recycled, remove excavated materials from Project site and legally dispose of them in an EPA-approved landfill.

   1. Do not allow milled materials to accumulate on-site.

END OF SECTION
PART 1 - GENERAL

A. Review Submittals:
   1. Product Data: Manufacturer’s standard data sheets describing components including materials, dimensions, relationship to adjacent construction, and attachments.

PART 2 - PRODUCTS

A. Contract Documents are based on products by Jay R. Smith Mfg. Co.
B. Substitutions will be of approved like kind.
   1. Refer to the Jay R. Smith Mfg. Co. catalog or website for assistance in selecting specific model numbers.

C. Catch Basin:
   1. Model: No. 9864-TM.
   2. Description: Modular precast polymer concrete catch basin with ductile iron frame, secured ductile iron slotted grate, preformed knockout panels on each side for connection to channels, and preformed 4 inch, 6 inch and 8 inch outlet knockouts.

D. Channel Support:
   1. Model: No. 9869-D.
   2. Description: Double arrow channel support.

E. Grate:
   1. Model: No. 9870 series.
   2. Description: Heavy duty grate.

PART 3 - EXECUTION

A. Install components in accordance with manufacturer’s instructions and approved product data submittals.
B. Set plumb, level, and rigid.

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 1 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes soil treatment for termite control.

1.3 SUBMITTALS

A. General: Submit the following according to Conditions of Contract and Division 1 Specification Sections.

B. Product data and application instructions.

C. Certification that products used comply with U.S. Environmental Protection Agency (EPA) regulations for termiticides.

1.4 QUALITY ASSURANCE

A. In addition to requirements of these specifications, comply with manufacturer's instructions and recommendations for preparing substrate and application.

B. Engage a professional pest control operator who is licensed according to regulations of governing authorities to apply soil treatment solution.

C. Use only termiticides that bear a federal registration number of the EPA and are approved by local authorities having jurisdiction.

1.5 JOB CONDITIONS

A. Restrictions: Do not apply soil treatment solution until excavating, filling, and grading operations are completed, except as otherwise required in construction operations.

B. To ensure penetration, do not apply soil treatment to frozen or excessively wet soils or during inclement weather. Comply with handling and application instructions of the soil toxicant manufacturer.

1.6 WARRANTY

A. Warranty: Furnish written warranty, executed by Applicator and Contractor, certifying that applied soil termicide treatment will prevent infestation of subterranean termites. If subterranean termite activity is discovered during warranty period, Contractor will re-treat soil and repair or replace damage caused by termite infestation.

B. Warranty Period: 5 years from date of Substantial Completion.

C. The warranty shall not deprive the Owner of other rights the Owner may have under other provisions of the Contract Documents and will be in addition to and run concurrent with other warranties made by the Contractor under requirements of the Contract Documents.
PART 2 - PRODUCTS

2.1 SOIL TREATMENT SOLUTION

A. General: Use an emulsible, concentrated termiticide that dilutes with water, specially formulated to prevent termites infestation. Fuel oil will not be permitted as a diluent. Provide a solution consisting of one of following chemical elements.

B. Available Products: Subject to compliance with requirements, products that may be incorporated in the Work include, but are not limited to, the following:

C. Products: Subject to compliance with requirements, provide one of the following:

1. Chloropyrifos:
   a. Dursban TC, Dow Chemical Co.

2. Permethrin:
   a. Dragnet FT, FMC Corp.
   b. Torpedo, ICI Americas, Inc.

3. Cypermethrine:
   a. Prevail FT, FMC Corp.
   b. Demon, ICI Americas, Inc.

4. Fenvalerate:
   a. Gold Coast Tribute, Du Pont.

5. Isofenphose:
   a. Pryfon, Mobay Corp.

D. Dilute with water to concentration level recommended by manufacturer.

E. Other solutions may be used as recommended by Applicator if approved for intended application by local authorities having jurisdiction. Use only soil treatment solutions that are not harmful to plants.

PART 3 - EXECUTION

3.1 APPLICATION

A. Surface Preparation: Remove foreign matter that could decrease treatment effectiveness on areas to be treated. Loosen, rake, and level soil to be treated, except previously compacted areas under slabs and foundations. Toxicants may be applied before placing compacted fill under slabs if recommended by toxicant manufacturer.

B. Application Rates: Apply soil treatment solution as follows:

1. Under slab-on-grade structures, treat soil before concrete slabs are placed, using the following application rates:
a. Apply 4 gallons of chemical solution per 10 linear feet (5.1 L of chemical solution per meter) to soil in critical areas under slab, including entire inside perimeter of foundation walls, along both sides of interior partition walls, around plumbing pipes and electric conduit penetrating slab, and around interior column footers.

b. Apply 1 gallon of chemical solution per 10 sq. ft. (4.1 L of chemical solution per sq. m) as an overall treatment under slab and attached slab areas where fill is soil or unwashed gravel. Apply 1-1/2 gallon of chemical solution per 10 sq. ft. (6.1 L of chemical solution per sq. m) to areas where fill is washed gravel or other coarse absorbent material.

c. Apply 4 gallons of chemical solution per 10 linear feet (5.1 L of chemical solution per meter) of trench for each 12 inches (300 mm) of depth from grade to footing, along outside edge of building. Dig a trench 6 to 8 inches (150 to 200 mm) wide along outside of foundation to a depth of not less than 12 inches (300 mm). Punch holes to top of footing at not more than 12 inches (300 mm) o.c. and apply chemical solution. Mix chemical solution with the soil as it is being replaced in the trench.

2. Under crawlspace and basement structures, treat soil along exterior and interior walls of foundations with shallow footings as specified above for exterior of slab-on-grade structures.

3. Treat soil under or around crawlspace structures as follows:

   a. Apply 4 gallons of chemical solution per 10 linear feet (5.1 L of chemical solution per meter) of trench along inside of foundation walls, along both sides of interior partitions, and around piers and plumbing. Do not apply an overall treatment in crawlspaces.

   b. Apply 4 gallons of chemical solution per 10 linear feet (5.1 L of chemical solution per meter) of trench, for each 12 inches (300 mm) of depth from grade to footing, along outside of foundation walls, including part beneath entrance platform porches, etc.

   c. Apply 4 gallons of chemical solution per 10 linear feet (5.1 L of chemical solution per meter) along the inside and outside of foundation walls of porches.

   d. Apply 1 gallon of chemical solution per 10 sq. ft. (4.1 L of chemical solution per sq. m) of soil surface as an overall treatment only where attached concrete platform and porches are on fill or ground.

4. At hollow masonry foundations or grade beams, treat voids at rate of 2 gallons per 10 linear feet (2.6 L per meter, poured directly into the hollow spaces.

5. At expansion joints, control joints, and areas where slabs will be penetrated, apply at rate of 4 gallons per 10 linear feet (5.1 L per linear m) of penetration.

C. Post signs in areas of application to warn workers that soil termitecide treatment has been applied. Remove signs after areas are covered by other construction.

D. Reapply soil treatment solution to areas disturbed by subsequent excavation, landscape grading, or other construction activities following application.

END OF SECTION
PART 1 – GENERAL

1.1 SCOPE OF WORK

A. Furnish all labor, material and equipment for the construction of the water distribution system as shown on the drawings from taps to the public system to building plumbing connection.

B. Testing and disinfection of the installed system is incidental to the work.

C. Furnish construction staking in accordance with generally accepted practice for layout of underground utilities.

D. The work includes coordination with building plumbing Contractors and building plumbing plans.

1.2 QUALITY ASSURANCE

A. Meet the requirements of the Local Jurisdiction. Where a conflict exists between this specification and the Local County, City or State specification, meet the most strict specification.

1.3 JOB CONDITIONS

A. Coordinate installation of the water distribution system with grading and paving operations.

B. After completion and testing of the water distribution system, furnish the Owner with the Contractor’s Material and Test Certificates required by the National Fire Protective Association.

PART 2 – PRODUCTS

2.1 PIPE

A. Ductile iron or PVC for diameters 4 inches and larger. Copper pipe or PVC for smaller diameter.

1. Use copper pipe Type K or L, furnished and installed in accordance with the requirements of the Georgia State Plumbing Code.
2. PVC pipe may be installed where permitted by local authorities:

   a. For domestic potable water service, meet ASTM D2241, PVC 1120, SDR 21, Class 200.
b. For fire protection systems, meet AWWA C900, rubber gasket joints, DR14, Class 200.

2.2 VALVES AND BOXES:

A. For valves 1” and larger use cast iron gate valves, AWWA C500 or C509, metal or resilient seated, made by a recognized valve manufacturer such as Mueller, Iowa, M&H or approved equal. Use valves constructed of an interchangeable parts system, with parts readily available, and meet the following requirements:

- Iron body bronze-mounted
- Double disc, parallel seat “O” ring seal, or resilient seat seals
- 150 psi minimum working pressure
- Counterclockwise (left) opening
- 2-inch operating nut
- Non-rising stem
- Joints as required for connection to main

B. Install underground valves in standard cast iron valve boxes. Use boxes of two-piece screw type, adjustable to suit the depth of bury and type of valve, with a minimum shaft diameter of 5 ¾ inches. Provide one operating wrench for each ten valves furnished, or fraction thereof.

2.3 WATER METERS:

A. Water meters will be furnished by Owner.

2.4 DETECTION TAPE

A. Lay metallic detection tape where PVC Pipe is installed atop the pipe in the trench no less than 18” and no more than 24” below finish grade.

B. Meet pipe manufacture’s specification.

2.5 BACKFLOW PREVENTERS

A. General: Manufactured backflow preventers, of size indicated for maximum flow rate and maximum pressure loss indicated.

B. Working Pressure: 150 psig (1035 kPa) minimum, unless otherwise indicated.

2.6 ANCHORAGES

A. Clamps, Straps and Washers: ASTM 506, Steel.

B. Rods: ASTM A 575, steel

C. Rod Couplings: ASTM A 197 (ASTM A 197M), malleable iron.

E. Cast-Iron Washers: ASTM A 126, gray iron.

F. Concrete Reaction Backing: Portland cement concrete mix, 3000 psig (20.7 Mpa).

PART 3 – EXECUTION

3.1 GENERAL

A. Line and Grade: Lay and maintain all pipe to the required lines and grades with fittings, valves, and hydrants at the required locations and with joints centered and spigots hung with all valve and hydrant stems plumb.

B. Protecting Underground and Surface Structures: Furnish at your own expense, temporary support, adequate protection and maintenance of all underground and surface utility structures, drains, sewers, and other obstructions encountered in the progress of the work.

C. Sub-Surface Exploration: Whenever necessary to determine the location of existing pipes, valves, or other underground structure, examine all available records and make all explorations and excavations for such purpose.

3.2 LAYING PIPE

A. General: Before lowering pipe into trenches, grade the bottom of the ditch so that when pipe is in the ditch, it will have a bearing for its entire length. Carefully examine the pipe for defects and clean the inside. After placing pipe into ditch, wipe free of all dirt, sand and foreign material the bell, gasket and spigot. Apply to the gasket and spigot a film of lubricant. Enter the plain ends of the pipe into the socket and force the pipe into the socket until it makes contact with the bottom of the socket.

B. Trench Water: At times when pipe laying is not in progress, plug the open ends of the pipe by approved means and so no trench water enters the pipe.

C. Cutting Pipe: Perform cutting of pipe for inserting valves, fittings or closure pieces in a neat and workmanlike manner without damage to the pipe, using approved mechanical cutters.

D. Direction of Laying: Unless otherwise directed, lay pipe with bell ends facing in the direction of laying. For lines on an appreciable slope, bells face upgrade.
E. Permissible Deflection: Whenever necessary to deflect pipe from a straight line either in the vertical or the horizontal plane to avoid obstruction, to plumb stems, or where long radius curves are permitted, use the degree of deflection recommended by the manufacturer of the pipe.

F. If wet or otherwise unstable trench conditions are encountered, undercut the trench 6 inches and install the pipe in #57 stabilization stone. If rock is encountered, undercut the trench 6 inches and install the pipe in #57 stone.

3.3 BACKFILLING

A. Immediately after pipes are laid, backfill all trenches and excavations, unless other protection for the pipe line is directed. Use backfilling material selected and deposited with special reference to the future safety of the pipes. Tamp solidly, clean earth or sand about the pipe up to the level of 6 inches above the top of the pipe and carefully deposit in uniform layers, solidly tamp or ram each layer with proper tools so as not to disturb or injure the pipeline. Mechanical means may be permitted for backfilling, provided the equipment meets the approval of the Owner. Ram or tamp the remainder of the backfilling in layers of not more than 6 inches in depth with either approved mechanical or hand tamps. Compact as specified under the EARTHWORK Section of these specifications.

B. Use backfilling material free of rock, trash and debris.

3.4 SETTING APPURTENANCES

A. Valve and Fittings: Set and joint gate valves and pipe fittings to new pipe in the manner previously specified for cleaning, laying, and jointing pipe.

B. Valve Boxes: Support, maintain center and plumb over the wrench nut of the gate valve with box cover flush with the surface of the finished pavement or at such other level as may be directed.

3.5 STERILIZATION

A. Sterilize in accordance with AWWA C601. Sterilize by the application of clear water containing a minimum of 50 ppm of available chlorine. Keep the chlorine bearing water in contact with the surfaces being sterilized for a period of not less than 24 hours. At the end of the contact period, maintain the chlorine residual in all units and at extremities of pipelines at a minimum concentration of 25 ppm.

B. Chlorinating Valves and Hydrants: Operate all valves and other appurtenances while the pipeline is filled with the chlorinated agent.

C. Final Flushing and Test: Following chlorination, thoroughly flush all treated water from the newly laid pipeline at its extremities until the replacement water throughout its length, upon test, meets the requirements of the Local Jurisdiction. Arrange for test samples.
D. Repetition of Procedures: Should the initial treatment prove ineffective, repeat the chlorinating procedure until confirmed tests show that water sampled conforms to the requirements previously stated.

3.6 ALTERNATE TESTING AND STERILIZATION

A. Local Jurisdiction may request alternate or additional testing and sterilization methods. Deviations from these methods may be employed with permission of the Local Jurisdiction.

3.7 WORK ON EXISTING MAINS

A. Connections

1. Connections between the new construction and existing mains may be made by the Local Jurisdiction.
2. Water service may be brought to the property line by the Local Jurisdiction. Connect site piping to the Local Jurisdiction main.
3. Verify the extent of Local Jurisdiction work and coordinate the work with the work of the Local Jurisdiction to provide proper locations and complete assemblies for the water service, meters, taps and appurtenances.

3.8 FEES

A. Contractor is responsible for payment of ANY AND ALL fees associated with the project. It is the Contractor’s responsibility to identify all fees related to permit, water main installation and clarify prior to bid submittal whether tap, meter, and any other fees to be paid.

END OF SECTION
PART 1 - GENERAL

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

1.2 SUMMARY
A. This Section includes sewerage and drainage systems outside the building. Systems include the following:
   1. Sanitary sewerage.

1.3 DEFINITIONS
A. Sewerage Piping: System of sewer pipe, fittings, and appurtenances for gravity flow of sanitary sewage.

1.4 PERFORMANCE REQUIREMENTS
A. Gravity-Flow, Nonpressure-Piping Pressure Ratings: At least equal to system test pressure.

1.5 SUBMITTALS
A. General: Submit each item in this Article according to the Conditions of the Contract and Division 1 Specification Sections.
B. Product data for the following:
   1. Backwater valves, cleanouts, and drains.

1.6 QUALITY ASSURANCE
A. Environmental Agency Compliance: Comply with regulations pertaining to sanitary sewerage and storm drainage systems.
B. Utility Compliance: Comply with regulations pertaining to sanitary sewerage and storm drainage systems. Include standards of water and other utilities where appropriate.
C. Product Options: Drawings indicate sizes, profiles, connections, and dimensional requirements of system components and are based on specific manufacturer types indicated. Other manufacturers’ products with equal performance characteristics may be
considered. Refer to Division 1 Section "Product Substitutions."

1.7 DELIVERY, STORAGE, AND HANDLING

A. Protect pipe, pipe fittings, and seals from dirt and damage.

1.8 PROJECT CONDITIONS

A. Site Information: Perform site survey, research public utility records, and verify existing utility locations.

B. Locate existing structures and piping to be closed and abandoned.

C. Existing Utilities: Do not interrupt existing utilities serving facilities occupied by the Owner or others except when permitted under the following conditions and then only after arranging to provide acceptable temporary utility services.

1. Notify Owner not less than 48 hours in advance of proposed utility interruptions.
2. Do not proceed with utility interruptions without receiving Owner's written permission.

1.9 SEQUENCING AND SCHEDULING

A. Coordinate sanitary sewerage system connections to utility company's sanitary sewer.

B. Coordinate with other utility work.

PART 2 - PRODUCTS

2.1 PIPES AND FITTINGS

A. PVC service line.

2.2 CLEANOUTS

A. Description: PVC.

PART 3 - EXECUTION

3.1 EARTHWORK

A. Excavating, trenching, and backfilling are specified in Division 2 Section "Earthwork."

3.2 SEWERAGE PIPING APPLICATIONS
A. General: Include watertight joints.

B. Refer to Part 2 of this Section for detailed specifications for pipe and fitting products listed below. Use pipe, fittings, and joining methods according to the following applications.

C. Pipe Sizes 4 and 6 Inches (100 and 150 mm): PVC pipe.

### 3.3 INSTALLATION, GENERAL

A. General Locations and Arrangements: Drawings (plans and details) indicate the general location and arrangement of underground sewerage and drainage systems piping. Location and arrangement of piping layout take into account many design considerations. Install piping as indicated, to extent practical.

B. Install piping beginning at low point of systems, true to grades and alignment indicated with unbroken continuity of invert. Place bell ends of piping facing upstream. Install gaskets, seals, sleeves, and couplings according to manufacturer's recommendations for use of lubricants, cements, and other installation requirements. Maintain swab or drag in line and pull past each joint as it is completed.

C. Use manholes for changes in direction, except where fittings are indicated. Use fittings for branch connections, except where direct tap into existing sewer is indicated.

D. Use proper size increasers, reducers, and couplings, where different sizes or materials of pipes and fittings are connected. Reduction of the size of piping in the direction of flow is prohibited.

E. Install gravity-flow-systems piping at constant slope between points and elevations indicated. Install straight piping runs at constant slope, not less than that specified, where slope is not indicated.

F. Extend sewerage piping and connect to building's sanitary drains, of sizes and in locations indicated. Terminate piping as indicated.

G. Install sewerage piping pitched down in direction of flow, at minimum slope of 2 percent (1:50) and 36-inch (1000-mm) minimum cover, except where otherwise indicated.

H. Extend drainage piping and connect to building's storm drains, of sizes and in locations indicated. Terminate piping as indicated.

I. Tunneling: Install pipe under streets or other obstructions, that cannot be disturbed, by tunneling, jacking, or a combination of both.

### 3.4 CLEANOUT INSTALLATION

A. Install cleanouts and riser extension from sewer pipe to cleanout at grade. Install piping so cleanouts open in direction of flow in sewer pipe.

B. Set cleanout frames and covers in concrete paving with tops flush with surface of paving.
3.5 TAP CONNECTIONS

A. Make connections to existing piping and underground structures so finished work conforms as nearly as practical to requirements specified for new work.

B. Use commercially manufactured wye fittings for piping branch connections. Remove section of existing pipe, install wye fitting into existing piping, and encase entire wye fitting plus 6-inch (150-mm) overlap, with not less than 6 inches (150 mm) of 3000-psi (20.7-MPa), 28-day, compressive-strength concrete.

C. Make branch connections from side into existing piping, sizes 4 to 20 inches (100 to 500 mm) by removing a section of existing pipe and installing a wye fitting into existing piping. Encase entire wye with not less than 6 inches (150 mm) of 3000-psi (20.7-MPa), 28-day, compressive-strength concrete.

D. Make branch connections from side into existing piping, sizes 24 inches (600 mm) or larger or to underground structures by cutting an opening into existing unit large enough to allow 3 inches (76 mm) of concrete to be packed around entering connection. Cut end of connection pipe passing through pipe or structure wall to conform to shape of and be flush with inside wall, unless otherwise indicated. On outside of pipe or structure wall, encase entering connection in 6 inches (150 mm) of concrete for a minimum length of 12 inches (300 mm) to provide additional support of collar from connection to undisturbed ground.

1. Use concrete that will attain a minimum 28-day compressive strength of 3000 psi (20.7 MPa), unless otherwise indicated.
2. Use epoxy bonding compound as an interface between new and existing concrete and piping materials.

E. Protect existing piping and structures to prevent concrete or debris from entering while making tap connections. Remove debris or other extraneous material that may accumulate.

3.6 FIELD QUALITY CONTROL

A. Clear interior of piping and structures of dirt and superfluous material as the work progresses. Maintain swab or drag in piping and pull past each joint as it is completed.

1. In large, accessible piping, brushes and brooms may be used for cleaning.
2. Place plug in end of incomplete piping at end of day and whenever work stops.
3. Flush piping between manholes and other structures, if required by authorities having jurisdiction, to remove collected debris.

B. Inspect interior of piping to determine whether line displacement or other damage has occurred. Inspect after approximately 24 inches (600 mm) of backfill is in place, and again at completion of the Project.

C. Test new piping systems and parts of existing systems that have been altered, extended, or repaired for leaks and defects.

END OF SECTION
PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes: Detectable warning systems.

1.2 QUALITY ASSURANCE

A. Qualifications: Installer shall have a minimum of five years experience in installations similar to this project and shall be approved by the detectable warning system manufacturer.

B. Regulatory Requirements: Detectable warning system shall comply with the applicable requirements of the following:
   1. Americans with Disabilities Act (ADA): Title 49 CFR Transportation, Section 4.29.2 Detectable Warnings on Walking Surfaces.
   2. International Building Code, Chapter 11, for detectable warning pavers.
   3. American National Standard Institute (ANSI)

1.3 DELIVERY, STORAGE, AND HANDLING

A. Reference Section 01600 for general delivery and storage requirements.

B. Deliver materials to project site in manufacturer’s original, unopened containers with labels indicating brand names, colors and patterns and quality designations legible and intact.

C. Store and protect materials in accordance with manufacturer’s recommendations.

1.4 SITE CONDITIONS

A. Adhere to manufacturer’s printed recommendations for environmental requirements.

B. Work area shall be free of traffic and any work by other trades during, and after installation, and shall be protected per manufacturer’s printed instructions.

C. Protect finished detectable warning system surfaces from damage by subsequent trades.

PART 2 - PRODUCTS

2.1 DETECTABLE WARNING SYSTEMS

A. Provide tactile cast-in-place panels or tiles or tactile concrete pavers incorporating inline truncated dome pattern measuring 0.2” in height, 0.9” diameter at the base, and 0.4” diameter at top of dome spaced 2.35” nominal as measured side by side. Provide one of the following products:
   1. Cast-In-Place Panels or Tiles:
      d. Cast in Place Detectable Warning Tile, by ADA Solutions, North Billerica, MA.
2. Concrete Pavers: By one of the following manufacturers:

3. Color: Red or yellow

2.2 ACCESSORIES

   A. Cleaner: As recommended by manufacturer.
   B. Sealer: As recommended by manufacturer.
   C. Concrete Paver Accessories:
      1. Bedding Sand: Clean, non-plastic, free from deleterious or foreign matter, symmetrically
         shaped, natural or manufactured form crushed rock.
      2. Joint Sand: Fine, sharp, washed natural sand or crushed stone with 100 percent passing
         No. 16 sieve and no more than 10 percent passing No. 200 sieve.
      3. Geotextile Fabric: Refer to Section 02340.

PART 3 - EXECUTION

3.1 EXAMINATION

   A. Examine surfaces and adjacent areas where products will be installed and verify that surfaces
      or base materials conform to product manufacturer's requirements and as indicated on the
      drawings.
   B. Beginning of installation indicates acceptance of substrate conditions.

3.2 PREPARATION

   A. Protect utilities, drainage structures, curbs and any other structures within or adjacent to the
      treatment location against the application of the surface treatment materials.

3.3 INSTALLATION

   A. Install in the locations and pattern as shown on the drawings.
   B. Install as shown on the drawings and as recommended by the manufacturer's written instruc-
      tions.
   C. Cut pavers or panels with motor-driven masonry saw equipment to provide pattern indicated
      and to fit adjoining work neatly. Use full units without cutting where possible and avoid units cut
      to less than one quarter of original size
   D. Tolerances: Do not exceed 1/16-inch unit-to-unit offset from flush (lippage) or 1/8 inch in 10 feet
      from level, or indicated slope for finished surface of paving.
   E. Install pavers or panels with edges flush with adjacent non-tactile paving.
   F. Concrete Pavers:
      1. Mix pavers from several pallets or cubes, as they are placed, to produce uniform blend of
         colors and textures.
2. Place geotextile fabric over compacted base course.
3. Place bedding sand and screed to a thickness necessary to maintain uniform grade, taking care that moisture content remains constant and density is loose and constant until pavers are set and compacted.
4. Place pavers hand tight against spacer bars.
5. Vibrate pavers into leveling course with a low-amplitude plate vibrator.
6. Spread dry sand and fill joints immediately after vibrating pavers into leveling course. Vibrate pavers and add sand until joints are completely filled, then remove excess sand. Leave a slight surplus of sand on the surface for joint filling.
7. Apply and spread joint sand as necessary until joints remain full.

3.4 CLEANING

A. Thoroughly clean surfaces in a method recommended by manufacturer.

B. Replace discolored materials as required.

END OF SECTION
SECTION 02831 - CHAIN LINK FENCE AND GATES

PART 1 – GENERAL

1.1 SCOPE OF WORK
A. Furnish all labor, material and equipment necessary to install poly-vinyl coated (black) chain link fabric, posts, gates, wire and appurtenances. Fencing and gates as shown on Civil Plans shall be 6 foot high with barbs above shall be provided and installed.

1.2 REFERENCES
A. Standards of the following as referenced:

1.3 SUBMITTALS
A. Product data: Indicate material types, gauges, sizes and finishes, construction details including post spacing and foundation details.
B. Samples for selections.

PART 2 – PRODUCTS

2.1 MATERIALS
A. Fencing:
   1. Provide chain link fence meeting ASTM A491 or ASTM 4392 complete with supports, bracings, gates and other accessories to complete Work indicated.
   3. Fence shall be 6’ high to top of fabric. If specified, install forty-five degree arms supporting three strands of barbed wire above the fabric.
B. Posts:
   1. General: Form using round steel sections, galvanized per ASTM 123, of the following sizes:
   2. Corner and Terminal Posts: Post shall be constructed of schedule 40 steel pipe. They shall be hot-dipped galvanized with a minimum of 1.8 oz./sq. ft. of coated surface area. Post shall have an outside diameter of 2-3/8” (2.375”), a minimum wall thickness of .130” and a minimum weight per ft. of 3.117 lb.
   3. Line posts: Post shall be constructed of schedule 40 steel pipe. They shall be hot-dipped galvanized with a minimum of 1.8 oz./sq. ft. of coated surface area. Post shall have an outside diameter of 1-7/8” (1.875”), a minimum wall thickness of .120” and a minimum weight per ft. of 2.281 lb.
D. Top Rails and Braces: Shall be constructed of schedule 40 steel pipe. They shall be hot-dipped galvanized with a minimum of 1.8 oz./sq. ft. of coated surface area. Post shall have an
outside diameter of 1-5/8” (1.625”), a minimum wall thickness of .111” and a minimum weight per ft. of 1.83 lb.

E. Caps, Hardware and Misc.: Post caps shall be formed steel, cast malleable iron or aluminum alloy. Install one cap for each post where barbed wire supporting arms are not required. Top rail and brace ends shall be formed steel, malleable iron or cast iron for connection of rails and braces to terminal posts. Top rail sleeves shall be 6” and allow for expansion and contraction of top rails. Use 9 ga. galvanized steel wire for the attachment to fabric to posts. Double wrap 13 gauge for rails and braces. Hog ring ties of 12-1/2 gauge for attachment of fabric to tension wire. Tension bars shall be in one piece lengths equal to 2” less than full height of fabric with a minimum cross-section of 3/16” x ¾”. Install tension bars where chain link fabric meets terminal posts. Install 7-gauge zinc coated tension wire with tensile strength of 75,000 psi at bottom of fence fabric.

F. Barbed Wire and Supporting Arms: Barbed wire shall be double strand 12-1/2 gauge galvanized twisted steel line wire, 4-point galvanized steel barb shall be placed approximately 5” on center. Support arms shall be galvanized pressed steel with provision for supporting three stands of barbed wire. Arms shall withstand 250 lb. downward pull at outermost end without failure.

G. Concrete: Concrete for setting posts shall be 3,000-psi compression strength at 28 days.

H. Gate Frame: Fabricate gate frames from galvanized steel pipe with an outside diameter of not less than 1.9” and a weight per foot of 2.72 lb. Weld connections to form a rigid one-piece unit.

I. Gate Hardware: All hardware shall be constructed from hot-dipped galvanized steel. All moveable parts shall be field coated to match adjacent finishes.

K. Gate Hinges: Hinges shall be structurally capable of supporting gate leaf.

L. Stretcher bars: 3/16” by 3/4” galvanized steel, 2” less in length than fabric width. Provide one stretcher bar at each gate and end post; two at each corner and pull post.

M. Poly-Vinyl Coating

1. Provide poly-vinyl extruded coating, 0.015 inches minimum coating thickness, conforming to ASTM F-668, in black.

2. Adhere coating to fabric, posts and appurtenances specified, or otherwise exclude water from entering between coating and coated materials.

N. Siding Gates: Comply with ASTM F 1184

1. Cantilever - Manufacturer’s standard top rail gate incorporating a track for the top roller. Brace frame to prevent sagging. Provide a lockable positive latch and other hardware and accessories as required.

   (a) Class 1: Provide external rollers with accessible grease fittings, a safety enclosure, and guide posts to keep the gate on the rollers.


1. Color: To be selected by Architect from a full range of manufacturers standard colors.
2.2 GATE OPERATOR

A. General: Manufacturer's standard design and construction, suitable for gates specified. Select operator size and features according to manufacturer's published data, taking into consideration size, type, weight, and construction of gate, as well as Project conditions and specified requirements.

B. Type: Electric motor with enclosed gear reducer and chain drive.

C. Type: Hydraulic drive for smooth, shock-free actuation.

D. Speed: Minimum 60 feet per minute.

E. Features: Continuous duty without overloading or overheating. Rated by manufacturer at 30 or more complete cycles per hour. All components UL approved. Furnish disconnect switch with NEMA KS 1; Type 3R enclosure.

1. Provide equipment with suitable electrical characteristics including phase, voltage, branch circuit wire size, overcurrent protection, and connection devices coordinated with Division 16.

2. Self-locking.

3. Weather-resistant steel enclosure protecting all operating parts.

4. Automatic reversing upon obstruction during closing cycle and automatic stop upon obstruction during opening cycle.

F. Controls: Electric and electronic programmable controls separated from motor and drive mechanism, sealed from water and insects, with space for additional optional equipment. Provide adjustable automatic closing timer and the following remote control device:

1. Single-button control.

2. Three-button open/close/stop switch.

3. Card reader with codes to allow four different access periods.

4. Vehicle loop and loop detection system: Located for exit access only complying with the following requirements:

   a. Below paving or flush with paving.

5. Fire Strobe 2000 system or approved equivalent complying with the following requirements:

   a. Frequency: 14Hz for class II signals

   b. Responds to both OPTICOM and STROBECOM II emitters.

   c. Strobe acquisition time: 0.5 seconds

   d. PC board construction: enclosed 8"x8"x4" rain tight NEMA J-Box

   e. Power requirements: 12/24 Volts AC/DC non polarity conscious, approximately 1 Watt

PART 3 – EXECUTION

3.1 INSTALLATION

A. Fence Framing: Install in accordance with ASTM F 567 and manufacturer’s instructions. Locate terminal posts at each fence termination. Space line posts at 10 feet centers. Concrete set all posts in holds bored with a diameter at least 4 times greater than the outside dimensions of the post. Holes shall be 42" deep. Set post bottoms 36” below grade. Place concrete in a continuous pour, trowel finish the surface and slope to direct water away from posts. Install
horizontal pipe brace at mid-height on each side of terminal posts. Install diagonal truss rods at these points; install braces and adjust truss rod. Install bottom tension wire before stretching fabric and attach to each post with ties or clips. Install the top rail in lengths of 21 feet. Connect top rail joints with sleeves for rigid connection with expansion/contraction. Install fabric on security side, attach so that fabric remains in tension after pulling force is released. Leave approximately 2” between finished grade and bottom of selvedge. Attach fabric with wire ties or clips to line posts at 15” on center, to rails, braces, and tension wire at 24” on center. To install tension bars, pull fabric taut, thread bar through fabric and attach to terminal posts with bands or clips spaced a maximum of 15” on center.

B. Gates: Install gates plumb, level and secure for full opening without interference. Attach hardware by means which will prevent unauthorized removal. Adjust hardware for smooth operation.

C. Accessories: Bend ends of tie wires to minimize hazard to persons and clothing. Install nuts or fasteners opposite the fabric side of the fence for added security. Install extension wires on posts and align perpendicular to the fence. Uniformly space parallel rows of barbed wire on the security side of the fence. Pull wire taunt and attach in clips or slots of each extension.

D. Barbed Wire and Tension Wire: Install wire when indicated on the drawings.

E. Protect surfaces from damage until Certification of Substantial Completion date. Replace components damaged prior to Certificate of Substantial Completion date.

END OF SECTION
PART 1 GENERAL

1.1 SECTION INCLUDES

A. Scope of Work: Seal all interior and exterior concrete on the project site including but not limited to stoops, walls, landings, sidewalks and floors all other existing and proposed concrete surfaces on the job site where concrete is the intended final surface.

B. Surface preparation. Surface shall be clean of debris and otherwise prepared in accordance with manufacturers recommendations.

C. Application of clear, acrylic, slip resistant curing and sealing compound.

1.2 REFERENCES


C. AASHTO M 148 - Liquid Membrane Forming Compounds for Curing Concrete.

D. United States Department of Agriculture.

1.3 SUBMITTALS

A. Comply with Section 01330 - Submittals.

B. Submit manufacturer's product data and application instructions.

1.4 DELIVERY, STORAGE, AND HANDLING

A. Deliver materials to site in manufacturer's original, unopened containers and packaging, with labels clearly identifying product name and manufacturer.

B. Store materials in a clean dry area in accordance with manufacturer's instructions.

C. Keep away from sparks and flames.

D. Avoid direct contact with this product as it may cause irritation of the eyes and/or skin.

E. Protect materials during handling and application to prevent damage or contamination.

F. Do not dilute curing and sealing compound.

1.5 ENVIRONMENTAL REQUIREMENTS

A. Apply curing and sealing compound in exterior applications only.
B. Do not apply curing and sealing compound if the temperature of the concrete is below 40°F (4°C).

C. Avoid application in direct sunlight combined with high temperatures.

D. Do not apply to concrete exposed to excessive moisture.

E. Do not use on dense or non-porous surfaces.

PART 2 PRODUCTS

2.1 MANUFACTURER

A. Provide slip resistant concrete sealer by one of the following manufacturers:
   4. Or Approved Equal.

2.2 MATERIALS

A. Acrylic curing and sealing compound shall be a non-yellowing, clear, slip resistant, acrylic curing and sealing compound meeting the following requirements:
   1. ASTM C309, Type 1, Class A and B.
   2. AASHTO M 148, Type 1, Class B.
   3. ASTM C1315 Ultraviolet Resistance – Class A - Non-yellowing 
      Chalk Resistance – No chalking 
      Check/Peel Resistance – No deterioration
   4. Dried film accepted by USDA.

PART 3 EXECUTION

3.1 EXAMINATION

A. Examine surfaces to receive curing and sealing compound. Notify Architect if surfaces are not acceptable. Do not begin surface preparation or application until unacceptable conditions have been corrected.

3.2 SURFACE PREPARATION

A. Protect adjacent surfaces not designated to receive curing and sealing compound.

B. Clean and prepare surfaces to receive curing and sealing compound in accordance with manufacturer's instructions ensuring that all stains, oil, grease, form release agents, dust and dirt removed prior to application.
C. Ensure surface is clean and free from all powdered release agent residue.

D. Apply curing and sealing compound when surface water has completely disappeared on new concrete.

E. Ensure concrete surface will not be marred by walking workmen.

3.3 APPLICATION

A. Apply curing and sealing compound in accordance with manufacturer’s instructions.

B. Mix curing and sealing compound thoroughly.

C. Apply a uniform film using a standard industrial-grade sprayer, equipped with a neoprene hose and gaskets, as well as a 9505-E spray tip at a rate of 600 square feet per gallon. Alternatively, apply using a short nap roller.

D. Apply a second coat at right angles to the first at a rate of 600 square feet per gallon.

E. Stir occasionally during application to ensure particles remain suspended.

3.4 PROTECTION

A. Restrict foot traffic for at least 4 hours, 12 hours is preferable.

END OF SECTION
PART 1 - GENERAL

1.1 DESCRIPTION

A. Work included forms for all cast-in-place concrete indicated on the Drawings and subsequent removal of all such forms except those earthforms described in this Section.

B. Work related but specified elsewhere includes:
   1. Cast-in-place concrete
   2. Concrete Reinforcement.

1.2 QUALITY ASSURANCE

A. Provide at least one person who shall be present at all times during execution of this portion of the work who shall be thoroughly familiar with the type of materials being installed, the referenced standards, and the requirements of this work, and who shall direct all work performed under this Section.

B. In addition to complying with all pertinent codes and regulations, comply with all pertinent recommendations contained in "Recommended Practice for Concrete Formwork," publication ACI 347 of the American Concrete Institute. Where provisions of pertinent codes and standards conflict with the requirements of this Section of these Specifications, the more provisions shall govern.

1.3 PRODUCT HANDLING

A. Use all means necessary to protect formwork materials before, during, and after installation and to protect the installed work and materials of all other trades.

B. In the event of damage, immediately make all repairs and replacements necessary to the approval of the Architect and at no additional cost to the Owner.

PART 2 - MATERIALS

2.1 FORM MATERIALS

A. All form lumber in contact with concrete exposed to public view shall be new except as allowed for re-use of forms in Article 3.5 of this Section of these Specifications, and lumber shall be one of the following, a combination thereof, or an equal approved in advance by the Architect:
   1. For concrete exposed to public view - Material shall be 3/4" 5 ply, structural grade waterproof plywood conforming to Product Standard PS-1-83, or metal forms as indicated in "Recommended Practice for Concrete Formwork," ACI 347.
   2. For unexposed concrete - Materials shall be the same as in Article 2.1.A.1 or No. 2 Southern Yellow Pine, 54S.

B. All form sealers shall be first quality of their respective kinds and subject to the approval of the Architect.

2.2 TIES AND SPREADERS

A. All Form ties shall be a type which does not leave an open hole through the concrete and which permits neat and solid patching at every hole.

B. When forms are removed, all metal shall be not less than one inch from the surface.
C. Do not use wire ties and wood spreaders.

D. Alternate forming systems may be used subject to the advance approval of the Architect.

E. All other materials, not specifically described but required for proper completion of concrete formwork, shall be subject to the advance approval of the Architect.

PART 3 - INSTALLATION

3.1 SURFACE CONDITIONS

A. Prior to work required in this Section, carefully inspect the installed work of all other trades and verify that all such work is completed to the point where this installation may properly commence. Verify that forms may be constructed in accordance with all pertinent codes and regulations, the referenced standards, and the original design.

B. In the event of discrepancy, immediately notify the Architect. Do not proceed with installation in areas of discrepancy until all such discrepancies have been fully resolved.

3.2 CONSTRUCTION OF FORMS

A. Construct all required forms to be substantial, sufficiently tight to prevent leakage of mortar, and able to withstand excessive deflection when filled with wet concrete.

B. Layout:

1. Construct forms for all required cast-in-place concrete to the shapes, sizes, lines, and dimensions indicated on the Drawings.

2. Exercise particular care in the layout of forms to avoid necessity for cutting of concrete after it is in place.

3. Make proper provision for all openings, offsets, recesses, anchorage, blocking, and other features of the Work as shown or required.

4. Perform all forming required for work of other trades and do all cutting and repairing of forms required to permit such installation.

5. Carefully examine the Drawings and Specifications and consult with other trades as required relative to provision for opening, reglets, chases, conduit and other items in the forms.

C. Set all required steel frames, angles, grilles, bolts, inserts, and other such items required to be anchored in the concrete before the concrete is placed.

D. Coat wood and metal forms with non-staining form release agent prior to placing reinforcement. Excess form release agent shall not be allowed to stand inside forms or come in contact with fresh concrete. Form release agent shall be compatible with paint, waterproofing materials to be applied to finished surface, and shall not stain or color concrete. Use form release agent in strict accordance with manufacturer's recommendations.

E. Bracing:

1. Properly brace and tie the forms together so as to maintain position and shape and to ensure safety to personnel.
2. Construct all bracing, supporting members, and centering of ample size and strength to safely carry, without excessive deflection, all dead and live loads to which they may be subjected.

3. Properly space forms apart and securely tie them together, using metal spreader ties that give positive tying and accurate spreading.

F. Construct all forms straight, true, plumb, and square within the tolerances listed in table 4.3.1 of "Specification of Structural Concrete for Buildings," ACI 301.

G. Keep forms sufficiently wetted to prevent joints opening up before concrete is placed.

3.3 PLYWOOD FORMS

A. Design - Nail the plywood panels directly to studs and apply in a manner to minimize the number of joints.

B. Make all panel joints butt joints with all edges and square.

3.4 FOOTING FORMS

A. All footing forms shall be wood unless otherwise specifically approved by the Architect.

B. Upon approval of the Architect, side forms for footings may be of earth provided the soil will stand without caving and the sides of the bank are made with a neat cut to the minimum dimensions indicated on the Drawings. Make all necessary provisions to prevent cave-ins during placement of concrete.

3.5 RE-USE OF FORMS

A. Forms to be used more than once shall be maintained clean and in good condition as to accuracy, shape, strength, rigidity, tightness and surface smoothness. Do not use damaged forms or forms producing work not equal to work resulting from using new material.

B. Requirements:
   1. Except as specifically approved by the Architect, re-use of forms shall in no way delay or change the schedule for placement of concrete from the schedule obtainable if all forms were new.
   2. Except as specifically approved in advance by the Architect, re-use of forms shall not impair the structural stability to the forms nor create a less acceptable appearance to finish concrete.

3.6 REMOVAL OF FORMS

A. Assume full responsibility for removal of formwork and forms shall be removed in such a manner as to ensure complete safety of structure.

B. Under ordinary weather conditions, wall forms, column forms, side of beam forms and other vertical forms for concrete which does not span between definite supports may be removed after two days.

C. Concrete slabs, and other members which span between definite supports shall attain 70 percent of the specified 28-day strength before removal of the forms. Shores for cantilevered beams and slabs shall remain in place for at least an additional 14 days.
D. After removing forms, horizontal members shall be promptly re-shored at mid-span until 28-day strength of concrete is obtained. No floor shall be loaded in excess of live loads for which designed unless adequate shores are placed beneath members supporting the concentration of load.

E. Cut nails and tie wires of form ties off flush and leave all surfaces smooth and clean.

F. Remove metal spreader ties on exposed concrete by removing or snapping off inside the wall surface and pointing up and rubbing the resulting pockets to match the surrounding areas.

G. Flush all holes resulting from the use of spreader rods and sleeve nuts, using water, and then solidly pack throughout the walls thickness with cement grout applied under pressure by means of a grouting gun; grout shall be one part Portland cement to 2 ½ parts sand; apply grout immediately after removing forms.

END OF SECTION
PART 1 - GENERAL

1.1 DESCRIPTION

A. Work covered by this Section: Include furnishing and placing of concrete reinforcing steel and accessories.

B. Work related but specified elsewhere includes:
   1. Reinforcement for masonry.

1.2 QUALITY ASSURANCE

A. Work covered by this Section: Comply with the recommendations contained in the American Concrete Institute's Manual of Standard Practice for Detailing Reinforced Concrete Structures, ACI-315.

B. Scaled dimensions from drawings shall not be used to determine bar lengths.

C. Perform concrete reinforcement work in accordance with CRSI Manual of Standard Practice, Documents 63 and 65.

D. Conform to ACI 301 and 315.

E. Conform to the recommendations in AWS D12.1 and D1.4 for welding of inserts, connections and reinforcing steel.

1.3 SUBmittALS

A. Shop Drawings: Bending diagrams, placement drawings and bar list shall be prepared and submitted to the Architect for review and shall be accepted by the Architect prior to cutting or bending of any bars. Submit shop drawings for review a minimum of 10 working days prior to fabrication of bars.

1.4 STORAGE AND HANDLING

A. Reinforcing Steel: Shall be bundled and clearly tagged, indicating locations, length and size of each piece. Markings shall be coordinated with the Placement Drawings. Reinforcing steel and accessories shall be stored on blocks above ground to prevent rusting and accumulation of dirt, grease or other bond breaking coatings.

PART 2 - MATERIALS

2.1 CONCRETE REINFORCEMENT

A. Reinforcing bars shall conform to ASTM A-615, Grade 60.

B. Welded wire fabric shall conform to ASTM A-185 with spacing and sizes as shown on the drawings.

C. Accessories shall be ferrous metals and shall be galvanized where exposed.

D. Chairs, bolsters, spacers and the like shall be performed and manufactured for the express use intended and in compliance with ACI Code. These items shall be plastic-coated metal when used
in slabs, or beams, where the underside of the slab or beam is to be left exposed, painted or is to receive plaster.

E. Concrete blocking for slabs on grade, footings, etc., 2" x 2" times required height (3,000 psi.).

PART 3 - INSTALLATION

3.1 FABRICATION

A. All bars shall be bent cold and bending shall conform to ACI - 315.

B. Bars shall not be field bent, unless prior approval is obtained from the Engineer. Weld reinforcing bars in accordance with AWS D1.4.

3.2 PLACING

A. Reinforcing shall be clean and free of flaky or loose rust, oil, paint or other foreign coatings.

B. Reinforcing shall be lapped, tied, or otherwise supported and secured to prevent movement during placing.

C. Concrete protection for reinforcing shall conform to ACI-318 unless shown otherwise on the drawings.

D. Bars indicated as continuous on drawings shall be lapped, spliced a minimum of 30 bar diameters. Splices shall not occur at critical locations.

E. Welded wire fabric in structural slabs: Shall be lapped at least 3" meshes plus and extension of the wires, but not less than 12". Welded wire fabric in slabs-on-grade shall be lapped at least 1 mesh.

F. Reinforcement shall be accurately placed and securely tied at intersections and spliced with sixteen (16) gauge black annealed wire, and shall be securely held in position during the placing of concrete by means of steel chairs or precast concrete block supports. Wire-tie ends shall point away from the form. Unless otherwise indicated on the drawings or specified, the number, type and spacing of supports shall conform to the ACI detailing.

G. Reinforcing bar dowels shall be anchored into position prior to pouring of any concrete.

3.3 INSPECTION

A. Reinforcing shall be inspected by the Engineer prior to pouring of any concrete. Notify the Engineer a minimum of 48 hours prior to the time the work requires the inspection.

END OF SECTION
PART 1 - GENERAL

1.1 DESCRIPTION

A. Work included but not necessarily limited to:
   1. Furnishing and placing of cast-in-place concrete.
   2. Setting under anchor bolts, thresholds, inserts and other embedment.

B. Work related but specified elsewhere includes:
   1. Concrete reinforcement.
   2. Concrete formwork.
   3. Concrete finishes

1.2 QUALITY ASSURANCE

A. Materials and installation shall meet requirements and be in accordance with ACI documents (latest editions), except where requirements of the Contract Documents, or of governing codes having jurisdiction, are more stringent.

B. An independent testing agency as approved by Architect to conduct test and perform other services specified for quality control during construction.

C. Dimensions scaled from drawings shall not be used to determine concrete sizes.

D. Field reference manual (Sp-15) as published by American Concrete Institute (ACI) shall be in site office at all times.

E. Obtain materials from the same source for the entire project.

1.3 SUBMITTALS

A. Submit within 30 days after award of Contract, and before any concrete is placed, a mix design for each strength of concrete shown on the drawings. The mix design shall have a complete list of all materials proposed to be furnished and installed under this portion of the work. Show manufacturer's name, catalog number of all items such as admixtures and membrane, and the name and address of transit mix concrete supplier.

B. Delivery Tickets: furnish with each load of concrete delivered. The delivery ticket shall show the class and strength of the concrete, number of pounds or cement per cubic yard; maximum size aggregate, slump ordered and amount and type admixtures.

C. Keep a record of the job site showing time and place of each pour of concrete together with delivery tickets. Records shall be available to the Architect upon request. Submit records and delivery tickets to Architect upon completion of the work.

D. Field mock-up of polish finish: prior to final polish of interior slab, provide test area for review and approval by Architect. Test area shall be maintained clean and free of damage for review and comparison of quality of remaining floor finishes.

PART 2 - MATERIALS

2.1 CONCRETE MATERIALS

A. Cement: Portland Cement, Type I or III from one source and conforming to ASTM C150.
B. Aggregates:
   1. Coarse Aggregate shall be clean, local and conform to ASTM C-33 and shall be size 57 throughout.
   2. Fine Aggregate shall be clean, local, well graded and be natural or manufactured concrete sand and conforming to ASTM C-33.
   3. Aggregate for lightweight concrete shall conform to ASTM C-330.

C. Water: clean and potable.

D. Wedge Inserts: ductile iron conforming to ASTM A-536.

E. Admixtures shall conform to ASTM C494 and:
   1. Water-reducing and/or retarding Type A and Type D as approved by Architect.
   2. Calcium chloride accelerators shall not be used.
   3. High-range water reducers (superplastizers) shall conform to ASTM C494
   4. Integral Color (Liquid Coloring Agent). Color to be selected by Architect from a full range of colors by one of the following manufactures:
      a. L.M. Scofield
      b. Solomon Colors
      c. Davis Colors
      d. Direct Colors

F. Air entraining admixtures shall conform to ASTM C260.

G. Curing Compounds: conform to ASTM C309-93 Type 1, Class B and shall be of non staining type. Compound shall be compatible with proposed floor finish. Submit technical data to Architect for approval prior to use.

H. Vapor Barrier: 6 mill minimum polyethylene sheet.

I. Expansion Joint Material: Pre-molded asphalt impregnated fiber with thickness indicated conforming to Federal Specification HH-F-341F, Type III.

J. Joint Sealer: conform to ASTM D1190 or ASTM D1850 and deliver to site in manufacturer's sealed containers. Joint sealer shall be of color to match adjacent masonry or concrete as approved by the Architect.

K. Granular Fill Under Floor Slabs: crushed rock or gravel conforming to ASTM C-33 and Size 57 and shall be free of earth, clay or other foreign substances.

L. Bonding Agent: "Weldcrete" as manufactured by Larsen Products Corporation, "Colmafix" as manufactured by Sika Chemical Corporation, "Darawel-C" as manufactured by W.R. Grace and Company.

M. Waterstops: Flat dumbbell type of center bulb-type at construction and other joints as indicated. Size to suite joint. Provide either pvc or rubber units conforming to Corps of Engineers Specification CRD-C51 for rubber units and CRD-C572 for pvc units.

N. Expansion Bolts: Conform to FF-S-325.

2.2 MIXES AND BATCHES

A. Transmit Mixed Concrete: conform to ASTM C-94.
B. Concrete Mix Design: shall be in accordance with Section 4.3 (field experience) or (trial batches) of ACI-318, and be within the following limits:

C. Concrete Normal Weight: compression strength at 28 days shall be as noted on plans.

2.3 CONSOLIDATION

A. Vibrators: 2" to 22" in diameter.
B. Minimum Frequency: 10,000 impulses per minute.
C. Two vibrators shall be used with a spare immediately available in case of breakdown.

PART 3 - INSTALLATION

3.1 FIELD QUALITY CONTROL

A. Except as otherwise specified, testing will be performed by independent testing agency or agencies selected by the Architect and paid by the Owner.

B. Air Entrainment: determine the air content of concrete in accordance with the recommendations of ASTM C173. Minimum air content shall be 4% to 6%. For concrete strengths of 5,000 psi or greater, the minimum entrained air shall be 3% plus or minus 1%.

C. Concrete shall have a maximum water cement ratio of 0.45 unless noted otherwise.

D. Testing of Concrete:

1. Take four cylinders, for each day's pour, each change in mix design or cement or aggregate source, or each 100 cubic yards of concrete or 5000 square feet of concrete placed. One cylinder shall be tested at 7 days and two at 28 days and one held in reserve.

2. Determine strengths from test specimens taken according to ASTM C31 and ASTM C172, and cured and tested in accordance with ASTM C39.

3. Slump test shall be in accordance with ASTM C143. Take at least one test for each 100 cubic yards of concrete placed or 5000 feet of surface area placed. A minimum of one test shall be made for each day's pour.

3.2 PLACING CONCRETE

A. Mixing Concrete:

1. All concrete shall be transit mixed in accordance with ASTM C94.
2. All admixtures shall be added at the batching plant.
3. Water may be added to the mix at the site provided the maximum water/cement ratio or the maximum slump is exceeded. Any water added shall be from containers on the truck and filled at the batch plant. All water added shall be documented.
4. Maximum slump shall not exceed:

   a. Footings, drilled piers, pavement and slabs-on-grade 3 inches ± 1 inch
   b. Beams, columns, walls, supported slabs, and pool structures, 4 inches ± 1 inch

B. Placing Concrete:

1. Convey concrete from point of delivery to its place of final deposit by methods that will prevent segregation. Free fall of concrete more than 5 feet will not be allowed.
2. Only ferrous metal lined chutes shall be used. Thoroughly flush chutes with water after each use. Discharge water outside limits of the structure.

3. Re-tempering of concrete shall be prohibited.

4. Concrete shall be placed in the forms within one hour after water is added in mixture.

5. Concrete shall be spaded at surfaces to receive finish.

6. Surfaces against which concrete is to be placed shall be cleaned of all laitance, debris or other foreign and bond breaking materials prior to placement.

7. Prior to placing new concrete against concrete that has set, thoroughly roughen and clean the surface to receive new concrete of all foreign material and laitance, saturate with water and apply a coat of net cement grout. Place new concrete prior to grout attaining its initial set.

8. Do not place concrete which has attained its initial set or which has contained its mix water for more than 90 minutes.

9. Notify architect at least 24 hours prior to the start of concrete placing.

10. Placing will not be permitted when, in the opinion of the Architect, the sun, heat, wind or limitations of facilities furnished prevent proper finishing and curing.

11. Control concrete temperature at time of placement:
   a. To be not less than 45 degrees Fahrenheit.
   b. To be not more than 90 degrees Fahrenheit.

12. Unless approved by the Architect, do not start concreting when descending natural air temperature falls lower than 40 degrees Fahrenheit.

C. Compaction: all concrete shall be thoroughly consolidated by suitable means during placement and shall be thoroughly worked around reinforcement and embedded fixtures and into corners of forms. Vibrators as herein specified shall be used for consolidation along with other methods acceptable to the Architect.

D. Joints: all concrete joints shall be located as shown on the plans or as indicated herein and shall be located as to least impair the strength and water tightness of the structure.

1. Control Joints - Slab-on-grade: space at maximum 20 feet intervals in both directions. Saw cut joint or use tooled grooved joint to a depth of 1/5 slab thickness.

2. Construction Joints: locate not less than 5 feet from any other joints to which they are parallel for slabs-on-grade. For floors, joints shall be located near the middle of span of structural slabs, beams and girders, unless a beam intersects a girder at the middle locations. In this case, joints in the girder shall be offset a distance equal to twice the beam width. See drawings for specific location of joints in pools.

E. Finishing:

1. Unless otherwise indicated on the drawings, make all slabs even and uniform in appearance and, where no slope is required, level within " 1/8 inch in ten feet.

2. Where floor drains or floor slopes are indicated, slope slabs uniformly to provide even fill
3. Trowel all finished interior slabs to a smooth, hard finish in all areas subject to public traffic.

5. Finish depressed slabs for hard tile installation with rough broom after troweling is complete.

6. Surfaces intended to receive roofing or waterproof membranes shall be floated smooth after screeding, and shall be troweled lightly.

7. Place floors and slabs in accordance with ACI 302.

F. Curing: concrete shall be maintained above 50 degrees Fahrenheit and in a moist condition for at least the first 7 days after placement. Curing may be accomplished by use of the following methods or materials and subject to the limitations of ACI 308-71.

1. Water curing.
2. Sealing materials.
3. Curing compounds.
4. Insulating covers.

G. Protection: protect all concrete work against injury resulting from the elements, the placement, finishing or curing of the damage resulting from work by other trades or construction equipment. Finished concrete surface shall not be used to stockpile construction materials without prior approval of the Architect.

H. Finishes:

1. All unexposed floor slabs shall receive steel trowel finish. Slab shall be woodfloated to a smooth plane surface after screeding. When concrete has hardened sufficiently to prevent excess fines from working to surface, steel trowel to a smooth surface, free from defects. A second steel troweling shall be done, producing a plan, hard, dense finished surface. The finish plan shall not vary more than 1/8 inch in 10 feet.

2. All exposed interior floor slabs shall receive trowel finish and gloss polish finish.

I. Grouting of Bearing Plates:

1. Cement grout shall be proportioned of cement and sand, measured by volume, in the ratio of one to two. Maximum size of sand shall not exceed one half of the space to be grouted. Grout shall contain only enough water to facilitate placing and packing.

2. Premixed grouts shall be of the non-shrink type and shall be proportioned, placed and cured in accordance with the manufacturer’s recommendations.

3. No superimposed loads shall be transferred to cement group that has been in place less than 72 hours. Superimposed loads shall not be imposed on premixed grout prior to the time recommended by the manufacturer.

4. Cement grout shall be cured in accordance with Article 3.2.F “Curing.”

J. Embedded Items:

1. Conduits, pipes and sleeves of aluminum shall not be embedded in concrete.
2. Conduits, pipes and sleeves passing through a slab, wall or beam shall be placed so as to not impair significantly the strength of the construction.

3. Where conduits, pipes and sleeves are not shown on the plans, they shall satisfy the following:
   a. Outside diameter shall not exceed 1/3 the thickness of the slab, wall or beam in which they are embedded.
   b. They shall be spaced no closer than 3 diameters on center.

4. Set and build into the work anchorage devices and other embedded items required for other work that is attached to or supported by cast-in-place concrete. Use setting drawings, diagrams and directions provided by suppliers of the items to be attached thereto.

3.3 INSPECTION

A. Notify the Architect minimum of 24 hours prior to placing any concrete.

1. Locations to receive concrete shall have been inspected and found acceptable by the Architect prior to pouring of concrete in that location.

2. At the sole discretion of the Architect, any structural concrete poured without his acceptance may be required to be removed and replaced at the Contractor's expense.

3. Inspect all forms, reinforcing bar placement, embedded items, construction joints and other items to ensure they have been placed in accordance with the contract drawings and these specifications prior to placing any concrete. Verification of this inspection shall be submitted to the Architect upon request.

B. When the ambient temperature falls below 60 degrees Fahrenheit or rises above 95 degrees Fahrenheit, a complete record shall be kept of concrete temperatures and of protection given to concrete during placement and curing.

3.4 DEFECTIVE WORK

A. Immediately after forms have been removed, inspect all concrete surfaces and patch all pour joints, voids, rock pockets, from the holes, and other imperfections before the concrete is thoroughly dry. Do not patch until concrete has been inspected by the Architect.

B. Patching Minor Defective Areas:

1. Chip away to a depth of about one inch, leaving edges perpendicular to the surface; wet the area to be patched and a space of at least six inches wide around it to prevent being absorbed out of the mortar.

2. Coat the area to be patched with a Bonding Agent.

3. Patching mortar shall consist of one part cement to three parts sand, to a consistency as dry as possible within the requirement of handling and placing; thoroughly compact the mortar by ramming it into place.

4. Finish the patch to match adjacent surfaces and keep wet for at least seven days, provide and install all required protective covering.

C. Patching Major Deflector Areas:

D. If the defects are serious or effect the strength of the structure, or if patching does not
satisfactorily restore the quality and appearance of the surface, the Architect may require the concrete to be removed and replaced in accordance with the provisions of this Section, all at no additional cost to the Architect.

END OF SECTION
PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes precast concrete units in the following applications:
   1. Sill.
   2. Cap.

1.2 REFERENCES

A. The publications listed below form a part of this specification to the extent referenced. Publications are referenced within the text by the basic designation only.

B. ASTM International (ASTM):
   1. ASTM A 82 – Steel Wire, Plain, for Concrete Reinforcement.
   2. ASTM A 615 – Deformed and Plain Carbon-Steel Bars for Concrete Reinforcement.
   3. ASTM A 496 – Steel Wire, Deformed for Concrete Reinforcement.
   4. ASTM C 33 – Concrete Aggregates
   5. ASTM C 144 – Aggregate for Masonry Mortar
   6. ASTM C 150 – Portland Cement
   7. ASTM C 260 – Air-Entraining Admixtures for Concrete

C. American Concrete Institute (ACI):
   1. ACI 211.1 – Standard Practice for Selecting proportions for Normal, Heavyweight and Mass Concrete.
   2. ACI 318 – Building Code Requirements for Structural Concrete.

D. Concrete Reinforcing Steel Institute (CRSI):
   1. CRSI – Manual of Standard Practice

E. Precast / Prestressed Concrete Institute (PCI):
   1. PCI MNL 120 – Design Handbook – Precast and Prestressed Concrete
   2. PCI MNL 117 – Manual for Quality Control for Plants and Production of Architectural Precast Concrete Products.

1.3 QUALITY ASSURANCE

A. Design Standards: Comply with ACI 318 and the design recommendations in PCI MNL 120.

B. Quality-Control Standard: Comply with PCI MNL 117.

1.4 DELIVERY, STORAGE, AND HANDLING

A. Store units at Project site to prevent cracking, distorting, warping, staining, or other physical damage, and so markings are visible.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Steel Reinforcing:
   1. Reinforcing Bars: ASTM A 615, Grade 60, deformed.
   2. Plain-Steel Wire: ASTM A 82, as drawn.
   3. Deformed-Steel Wire: ASTM A 496.
B. Concrete: Portland Cement: ASTM C 150, Type I or Type III of same type, brand, and source.

C. Aggregate: Normal-Weight Aggregates: Except as modified by PCI MNL 117, ASTM C 33, with coarse aggregates complying with Class 5S.


E. Sand-Cement Grout: Portland cement, ASTM C 150, Type I, and clean, natural sand, ASTM C 144. Mix at ratio of 1 part cement to 2-1/2 parts sand, by volume, with minimum water required for placement and hydration.

2.2 CONCRETE MIXES

A. Proportion mixes by either laboratory trial batch or field test data methods according to ACI 211.1, with materials to be used on Project, to provide normal-weight concrete with the following properties:
   2. Maximum Water-Cementitious Materials Ratio: 0.45.

B. Water Absorption: 12 to 14 percent by volume, tested according to PCI MNL 117.

C. Add air-entraining admixture at manufacturer's prescribed rate to result in concrete at point of placement having an air content complying with PCI MNL 117.

2.3 FABRICATION

A. Cast concrete units in size and shape as indicted.


C. Reinforce precast architectural concrete units to resist handling, transportation, and erection stresses.

D. Mix concrete according to PCI MNL 117 and requirements in this Section. After concrete batching, no additional water may be added.

E. Thoroughly consolidate placed concrete by internal and external vibration without dislocating or damaging reinforcement and built-in items. Use equipment and procedures complying with PCI MNL 117.

F. Cure concrete, according to requirements in PCI MNL 117, by moisture retention without heat or by accelerated heat curing using low-pressure live steam or radiant heat and moisture.

G. Discard precast architectural concrete units that are warped, cracked, broken, spalled, stained, or otherwise defective unless repairs are approved by Architect.

H. Fabricate precast architectural concrete units straight and true to size and shape with exposed edges and corners precise and true so each finished panel complies with PCI MNL 117 product tolerances as well as position tolerances for cast-in items.

I. Fabricate sill in nominal dimensions, allowing for 3/8 inch mortar joints.

2.4 FINISHES
A. Finish exposed surfaces of precast architectural concrete units to a smooth surface finish free of pockets, sand streaks, and honeycombs, with uniform color and texture. Chamfer exposed edges of sills.

2.5 SOURCE QUALITY CONTROL

A. Quality-Control Testing: Test and inspect precast concrete according to PCI MNL 117 requirements.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Lay units with completely filled bed and head joints; butter ends with sufficient mortar to fill head joints and shove into place. Do not slush head joints. Remove excess mortar.

B. Dowel units into place as shown on the Drawings.

C. Maintain courses to uniform width. Align vertical joints. Provide joints equal and of uniform thickness.

D. Tool head and bed joints concave. Use tool with large enough radius that joint is not raked free of mortar.

E. Install precast architectural concrete units level, plumb, square, true, and in alignment without exceeding the non-cumulative erection tolerances of PCI MNL 117, Appendix I.

F. Seal sill units as shown in accordance with Section 07901 with sealant color to match mortar.

G. Clean exposed surfaces of precast concrete units after erection to remove markings, dirt, and stains.

END OF SECTION
PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
1. Concrete masonry units.
2. Brick unit masonry.
3. Mortar and grout.
4. Reinforcement, anchorages, and accessories.
5. Through-wall flashing.

B. Work Installed But not Furnished under this Section: Support plates and angles with anchor studs, sleeve anchors, expansion bolts, adhesive anchors, and anchor bolts which are embedded in masonry for supporting structural members.

C. Related Sections:
2. Section 03450 - Plant Precast Architectural Concrete: Precast sill units and wall caps.
3. Section 05500 - Metal Fabrications: Loose steel lintels and other metal components embedded in masonry.
5. Section 07901 - Joint Sealants: Rod and sealant at control joints.

1.2 REFERENCES

A. The publications listed below form a part of this specification to the extent referenced. Publications are referenced within the text by the basic designation only.

B. American Concrete Institute/American Society of Civil Engineers/The Masonry Society (ACI/ASCE/TMS) (Also known as Masonry Standards Joint Committee - MSJC standards):
2. ACI 530.1/ASCE6/TMS 602 - Specifications for Masonry Structures.

C. ASTM International (ASTM):
1. ASTM C 90 - Hollow Load-Bearing Concrete Masonry Units.
2. ASTM C 94 - Ready-Mixed Concrete.
3. ASTM C 129 - Non-Load-Bearing Concrete Masonry Units.
4. ASTM C 140 - Methods For Sampling And Testing Concrete Masonry Units And Related Units.
5. ASTM C 143 - Slump of Hydraulic Cement Concrete.
6. ASTM C 144 - Aggregate for Masonry Mortar.
7. ASTM C 150 - Portland Cement.
9. ASTM C 216 - Facing Brick (Solid Masonry Units Made from Clay or Shale.
10. ASTM C 270 - Mortar for Unit Masonry.
11. ASTM C 476 - Grout for Masonry.
12. ASTM C 549 - Perlite Loose Fill Insulation.
D. Mason Contractors Association of America (MCAA):
   1. Standard Practice for Bracing Masonry Walls Under Construction

1.3 PERFORMANCE REQUIREMENTS

A. Provide unit masonry and grout that develops compressive strengths (f’m) at 28 days as indicated on Drawings.

1.4 SUBMITTALS

A. Section 01330 - Submittals: Submittal Procedures.

B. Shop Drawings: Do not use reproductions of Contract Documents as shop drawings. Prepare shop drawings in accordance with ACI 315.
   1. Reinforcement:
      a. Include masonry notes on shop drawings that relate to proper placing of reinforcing and submit shop drawings for use in the field.
      b. Reinforcing shown shall include but not limited to vertical and horizontal wall reinforcement, dowels, bond beam reinforcement, embedded steel items and anchor bolts.
   2. Placement Drawings:
      a. Shop drawings shall include sides, front and rear elevations of building showing masonry walls full height and length; reinforcing size, quantity, spacing, location, length, and grade of steel; and control joint locations.

C. Product Data - Mortar and Grout.
   1. Mix Design. Submit Masonry Grout Mix Design for each type of grout, and mix design for mortar, including description of type and proportions of ingredients:
      a. Include test reports, in accordance with ASTM C 780 for mortar test specified in Part 3.
      b. Include test reports, in accordance with ASTM C 1019 for grout mixes required complying with compressive strength requirement.
   2. Proportion method used.
   3. Required environmental conditions.
   4. Assurance that mix is free of admixtures.

D. Statement of Compressive Strength of Masonry: For each combination of masonry unit type and mortar type, provide statement of average net area compressive strength of masonry units, mortar type, and resulting net area compressive strength of masonry determined in accordance with Tables 1 and 2 in ACI 530.1/ASCE6/TMS 602. Submit Shop Drawings and Product Data within 5 working days of Contract date.

E. Testing and Inspection Reports: Submit reports in accordance with Section 01400.

F. Samples:
   1. Submit two full size face samples (soaps) of each type of integral colored CMU specified, indicating color range.
   2. Obtain Architect's approval prior to manufacture of CMU.

1.5 QUALITY ASSURANCE

A. Construct masonry in accordance with ACI 530/ASCE 5/TMS 402 and ACI 530.1/ASCE6/TMS 602.

B. Regulatory Requirements: Special inspection and testing will be provided in accordance with the Building Code and as noted on the Drawings and will be performed under provisions of Section 01400.
C. Mock-up: Construct a masonry wall panel mockup to represent the exterior masonry wall.
   1. Locate, construct, clean, inspect, and remove in accordance with notes indicated on the Drawings.
   2. When accepted, mock-up will be used as standard of quality for masonry Work.
   3. Mock-up may not remain as part of the Work.

D. Preconstruction Testing of Grout:
   1. Preconstruction testing shall be performed by the Contractor.
   2. Determine and certify that proportions of ingredients for mix design will provide the specified compressive strength for each type of grout.
   3. Test mix design prior to beginning construction of CMU walls.

E. Source Limitations:
   1. Masonry Units: Obtain exposed masonry units of a uniform texture and color, or a uniform blend within the ranges accepted for these characteristics, through one source from a single manufacturer for each product required.
   2. Mortar Materials: Obtain mortar ingredients of uniform quality, including color for exposed masonry, from single manufacturer for each cementitious component and from one source or producer for each aggregate.

F. Fire-Resistance Ratings: Where indicated, provide materials and construction identical to those of assemblies with fire-resistance ratings determined per ASTM E 119 by a testing and inspecting agency, by equivalent concrete masonry thickness, or by other means, as acceptable to authorities having jurisdiction.

1.6 DELIVERY, STORAGE AND HANDLING

A. Store sand for mortar on plastic sheeting to prevent contamination by extraneous chemicals in earth beneath.

1.7 PROJECT CONDITIONS

A. Environmental Requirements (Cold Weather): Follow cold weather procedures of ACI 530.1/ASCE6/TMS 602. Include the following construction requirements for cold weather procedures.
   1. When Air Temperature is above 40 degrees F:
      b. Protection: Cover walls with plastic or canvas at end of workday to prevent water entering masonry.
   2. When Air Temperature is below 40 degrees F but over 32 degrees F:
      b. Protection: Cover walls and materials to prevent wetting and freezing. Cover material: plastic or canvas.
   3. When Air Temperature is below 32 degrees F but over 20 degrees F:
      a. Heating of Materials: In addition to above heating requirements, heat sand. Thaw frozen sand and frozen wet masonry units. Maintain masonry above 32 degrees F, by using auxiliary heat or insulated blankets for 16 hours after laying masonry units.
      b. Protection: With wind velocities over 15 mph, provide windbreaks during the work day and cover walls and materials at the end of the workday to prevent wetting and freezing.
   4. When Air Temperature is below 20 degrees F:
      a. Heating of Materials: In addition to above heating requirements, dry masonry units by heating to 40 degrees F.
b. Protection: Provide enclosures and supply sufficient heat to maintain masonry enclosure above 32 degrees F for 24 hours after laying masonry units.

B. Environmental Requirements:
1. Cold Weather Requirements: Comply with cold weather construction requirements contained in ACI 530.1/ASCE6/TMS 602. When the ambient air temperature is below 40 degrees F, heat mixing water to maintain mortar temperature between 40 degrees F and 120 degrees F until placed. When the ambient air temperature is below 32 degrees F, heat the sand and water to maintain this mortar temperature.
   a. Do not use frozen materials or materials mixed or coated with ice or frost.
   b. Do not build on frozen substrates.
   c. Remove and replace unit masonry damaged by frost or by freezing conditions.
2. Hot Weather Requirements: Comply with hot-weather construction requirements contained in ACI 530.1/ASCE6/TMS 602. When the ambient air temperature exceeds 100 degrees F, or 90 degrees F with a wind velocity greater than 8 mph, execute the following:
   a. Store masonry units out of direct sunlight.
   b. Do not spread mortar beds more than 4 feet ahead of masonry.
   c. Set masonry units within one minute of spreading mortar.

PART 2 - PRODUCTS

2.1 CONCRETE MASONRY UNITS
A. Unit Design: Modular two core units sized as indicated or scheduled. Provide special shapes necessary for bond beams, control and expansion joints, lintels, and special conditions.
   1. Provide units as required for indicated construction including sill units and solid cap units.
   2. Provide units with exposed faces which are uniform in appearance.
   3. Units to receive paint or coatings shall contain a minimum of 12% fly ash or Ground Granulated Blast Furnace Slag (GGBFS) as a replacement of the total cementitious content. Use of fly ash or GGBFS in painted or coated units is mandatory.

B. Hollow Load Bearing Units: ASTM C 90.
   1. Smooth CMU: Light weight or normal weight above finished floor; normal weight only below finished floor.
   2. Split Face CMU: Light weight or normal weight above finished floor; normal weight only below finished floor.

C. Solid Load-bearing Units: ASTM C 90.
   1. Smooth CMU: Light weight or normal weight above finished floor; normal weight only below finished floor.
   2. Split Face CMU: Light weight or normal weight above finished floor; normal weight only below finished floor.

D. Non-load Bearing Units: ASTM C 129.

E. Light Weight Aggregate: ASTM C 331, free of materials that will cause rusting, staining, or popouts.

F. Fire Resistance Classification: In accordance with UL, FM, WH, or SWRI listing and fire resistance rating required for CMU wall and partition assemblies and components. Provide units of minimum equivalent thickness specified for the fire rating and for corresponding aggregate type.

G. Integrally Colored CMU:
   1. Conform to CMU requirements specified above.
2. Integral mineral pigment coloring.
3. Integral Water Repellent: Provide exposed units made with integral water repellent specified in this Section. Units made with integral water repellent, when tested as a wall assembly made with mortar containing integral water-repellent mortar additive according to ASTM E 514, with test period extended to 24 hours, show no visible water or leaks on the back of test specimen.
4. Fly ash and slag are prohibited in integrally colored CMU.
5. Color to be selected by Architect or Owners Representative from a full range of manufacturer's standard colors.

H. Architectural Masonry: Hollow core half-height concrete block units manufactured to resemble appearance of face brick with the following characteristics:
1. Normal weight CMU conforming to requirements of hollow load bearing units specified above.
2. Integral mineral pigment coloring.
3. Integral water repellent for increased water resistance.
4. Fly ash and slag are prohibited in architectural masonry.
5. Manufacturers:
   a. Quik-Brik by Oldcastle. Contact: Oldcastle, Jim Cooper (877) 506-2745, jim.cooper@oldcastleapg.com
   b. Half-height CMU by Dolese. Contact: Billy Crooke (405) 613-5502.
   c. Wall Brick by Cemex, Asheville, NC. Contact: Michael Pike (800) 786-5620.
   d. Spec-Brik by Concrete Products Group, Denver, CO. Contact Bill Dawson at (800) 789-0872, info@concreteproductsgroup.com.
6. Color to be selected by Architect or Owners Representative from a full range of manufacturer's standard colors.

I. Ground Faced CMU:
1. Conform to ASTM C-90 requirements with minimum density of 110 pounds per cubic foot.
2. Integral mineral pigment coloring.
3. Integral Water Repellent: Provide exposed units made with integral water repellent specified in this Section. Units made with integral water repellent, when tested as a wall assembly made with mortar containing integral water-repellent mortar additive according to ASTM E 514, with test period extended to 24 hours, show no visible water or leaks on the back of test specimen.
4. Fly ash and slag are prohibited in integrally colored CMU.
5. DryBlock (or approved equivalent): provide manufacturer’s recommended amount.
6. Manufacturers: Provide one of the following or approved equal
   a. Westbrook Concrete Block Company
   b. Trenwyth by Echelon Masonry
   c. County Materials Corporation
7. Color to be selected by Architect or Owners Representative from a full range of manufacturer’s standard colors.

2.2 BRICK

A. General: Provide shapes indicated and as follows for each form of brick required.
1. Provide units without cores or frogs and with exposed surfaces finished for ends of sills and caps and for similar applications that would otherwise expose unfinished brick surfaces.

B. Provide special shapes for applications requiring brick of size, form, color, and texture on exposed surfaces that cannot be produced by sawing.
1. Provide special shapes for applications where stretcher units cannot accommodate special conditions, including those at corners, movement joints, bond beams, sashes, and lintels.

2. Provide special shapes for applications where shapes produced by sawing would result in sawed surfaces being exposed to view.

C. Face Brick: ASTM C 216 and as follows:

1. Grade and Unit Compressive Strength: Provide units with grade and minimum average net area compressive strength indicated below:

   (a) Grade: SW.
   (b) Grade: MW or SW.
   (c) 3000 psi (20.7 MPa).
   (d) 4400 psi (30.3 MPa).
   (e) 5500 psi (37.9 MPa).
   (f) 6400 psi (44.1 MPa).
   (g) 8000 psi (55.2 MPa).
   (h) Not less than the unit compressive strengths required to produce clay masonry construction of compressive strength indicated.

2. Surface Coloring: Brick with surface coloring, other than flashed or sand-finished brick, shall withstand 50 cycles of freezing and thawing per ASTM C 67 with no observable difference in the applied finish when viewed from 10 feet (3 m).

3. Type: FBS.
4. Type: FBX.
5. Type: FBA.
6. Size: Bricks manufactured to the following actual dimensions within tolerances specified in ASTM C 216:

   (i) Standard: 3-1/2 to 3-5/8 inches (89 to 92 mm) thick by 2-1/4 inches (57 mm) high by 8 inches (203 mm) long.
   (j) Modular: 3-1/2 to 3-5/8 inches (89 to 92 mm) thick by 2-1/4 inches (57 mm) high by 7-1/2 to 7-5/8 inches (190 to 194 mm) long.
   (k) Engineer Modular: 3-1/2 to 3-5/8 inches (89 to 92 mm) thick by 2-3/4 to 2-13/16 inches (70 to 71 mm) high by 7-1/2 to 7-5/8 inches (190 to 194 mm) long.
   (l) Closure Modular: 3-1/2 to 3-5/8 inches (89 to 92 mm) thick by 3-1/2 to 3-5/8 inches (89 to 92 mm) high by 7-1/2 to 7-5/8 inches (190 to 194 mm) long.

7. Application: Use where brick is exposed, unless otherwise indicated.

8. Color and Texture: To be selected by Architect or Owner’s rep from a full range of manufacturer’s standard colors.

2.3 MORTAR AND GROUT MATERIALS

A. Portland Cement: ASTM C 150, normal-Type I or Type II; gray color. Fly ash, slag, and pozzolans not permitted as substitutes for Portland cement except as otherwise specifically allowed.

B. Mortar Cement: ASTM C 1329, Type S
C. Fly Ash: ASTM C 618, Type C or F maximum 4 percent loss in ignition shall be used as a replacement for Portland cement in grout. Fly ash shall be a minimum of 25 percent and a maximum of 30 percent of the total cementitious content. Use of fly ash in the grout mix is mandatory.

D. Fly ash, slag and pozzolans not permitted as substitutes for Portland cement in mortar.

E. Masonry Cement: Not allowed.

F. Mortar Aggregate: ASTM C 144, standard masonry type; clean, dry, protected against dampness, freezing, and foreign matter.

G. Mortar Pigments: Natural and synthetic iron oxides and chromium oxides, compounded for use in mortar mixes. Use pigments with a record of satisfactory performance in masonry mortar.

H. Grout Aggregate: ASTM C 404; use of blast furnace slag is not permitted. Maximum coarse aggregate size, 3/8 inch.

I. Calcium chloride: Not permitted in mortar or grout. Chemicals containing Thyocyanates, Calcium Chloride or more than 0.1 percent chloride ions shall not be used.

J. Hydrated Lime: ASTM C 207, Type S.

K. Water: Potable.

L. Admixtures: Not permitted in mortar or grout except as otherwise specifically required herein.

M. Water-Repellent Admixture: Liquid water-repellent mortar admixture containing integral water repellent by same manufacturer as used with integral colored CMU as specified above.

2.4 MIXES - MORTAR

A. Mortar: Type "S", in accordance with the Proportion Specification of ASTM C 270.

1. Mixing of components on-site is acceptable.

2. Mixing on-site water and packaged dry blended mix for mortar (ASTM C 387 or C1329), that contains no masonry cement, is acceptable.

3. Use of ready mix mortar (ASTM C 1142) is prohibited.

4. Do not add admixtures of any kind to mortar mix except as otherwise specifically required herein.

B. Pointing Mortar: Duplicate original mortar proportions. Add aluminum tristearate, calcium stearate, or ammonium stearate equal to 2% of Portland cement weight.

C. Mortar Color (CMU): Match color of integrally colored or unpainted natural color CMU. Color of mortar at painted CMU is optional.

D. Mortar Color (Brick): To be selected by Architect from a full range of manufacturers standard colors.

2.5 MIXING – MORTAR

A. Thoroughly mix mortar ingredients in accordance with ASTM C 270, in quantities needed for immediate use.

1. Maintain sand uniformly damp immediately before the mixing process.

2. Provide uniformity of mix and coloration.

3. Do not use anti-freeze compounds.
4. If water is lost by evaporation, retemper only within 2 hours of mixing. Do not retemper mortar more than 2 hours after mixing.

2.6 MIXES - GROUT FILL

A. Grout fill for concrete masonry unit bond beams, lintels, and reinforced cells with reinforcing bars and embedded plates: Conform to ASTM C 476.
   1. Compressive Strength: 3000 psi minimum at 28 days, as determined in accordance with the provisions of ASTM C 1019.
   2. Slump: 8 inches, minimum; 11 inches, maximum, taken in accordance with ASTM C 143.
   3. Use coarse grout when grout space is equal to or greater than 4 inches in both directions.
   4. Use fine grout when grout space is smaller than 4 inches in either direction.
   5. Air entrainment shall not be used.
   6. Do not add admixtures of any kind to grout.

2.7 MIXING – GROUT

A. Batch and mix grout in accordance with ASTM C 94 or ASTM C 476 for site batched and mixed grout. Do not use anti-freeze compounds to lower the freezing point of grout.

2.8 REINFORCEMENT AND ANCHORAGES

A. Horizontal Joint Reinforcement: Ladder design, minimum 9 gage welded steel wire, hot dipped galvanized to 1.5 oz, ASTM A 153, Class B2. Width 1-1/2 to 2 inches less than wall thickness.

B. Deformed Bars: ASTM A 615, Grade 60. Shop fabricate reinforcement which is shown bent or hooked. Field bending not allowed.

C. Anchor bolts and threaded rods as shown embedded in masonry on structural drawings: ASTM A 307.

D. Adhesive for embedding threaded rods: Cartridge type two-component adhesive.
   1. HIT HY-150 by Hilti Corp.
   2. Epcon System, Ceramic 6 by ITW Ramset/Red Head
   3. Epoxy-Tie SET by Simson Strong Tie Co. Inc.

E. Bar Positioners for Vertical Wall Bars: Minimum 9 gage, galvanized wire.
   1. AA Wire Products Co.; Dallas, TX; (214) 637-1511.
   3. Wire-Bond; Charlotte, NC; (800) 441-8359.

2.9 TIE AND ANCHORS

2.10 ACCESSORIES

A. Joint Filler: Closed cell foam, oversized 50 percent; self-expanding.

B. Preformed Control Joint Filler:
   1. Regular Joint: 2-5/8 inches by 1-1/2 inches; rubber.
      b. Control Joint No. 9101, by Southern Construction Products, Inc.; Birmingham, AL; (800) 821-9296.
      c. Masonry Control Joint No. 571; by Greenstreak; St. Louis, MO; (800) 325-9504.
2. Tee Joint: 2-5/8 inches by 1 inch; rubber.
   b. Control Joint No. 9107, by Southern Construction Products, Inc.; Birmingham, AL; (800) 821-9296.
   c. Masonry Control Joint No. 572; by Greenstreak; St. Louis, MO; (800) 325-9504.

   1. Backerseal (Grayflex) expanding precompressed foam by Emseal Joint Systems, Ltd., Westborough, MA; (800) 526-8365.
   2. IlbruckWillseal 600 polyurethene foam joint sealing tape by Willseal USA, Pelham, NH; (800) 438-0684.

D. Through-Wall Flashing: Sheet copper, total metal weight 5 ounces per sq ft, laminated with protective coating on both sides. Provide one of the following:
   1. Copper Fabric or Copper Sealtight 2000, by Advanced Building Products Inc.; Springvale, ME; (800) 252-2306.
   2. Copper Fabric, by Sandell Manufacturing Co., Schenectady, NY; (800) 283-3888.
   3. York Copper Fabric Flashing or Multi Flash 500, by York Manufacturing, Inc.; Sanford, ME; (207) 324-1300.

E. Adhesive: As recommended by flashing material manufacturer.

F. Weeps: Galvanized steel or plastic tubes.

G. Grout Barrier: Provide one of the following:
   1. DA1015-DA1018 Dur-O-Stop, by Dur-O-Wal.
   2. MGS Grout Screen, by Hohmann & Barnard, Inc.

2.11 MASONRY FILL INSULATION

A. Non Formaldehyde Forming Foamed In Place Insulation: Subject to compliance with project requirements and local jurisdictional restrictions, manufacturers offering Foam In-Place Insulation tested and found compatible and non-detrimental within the indicated Underwriters Laboratory fire resistance assemblies which may be incorporated into the Work include the following:
   1. Core-Fill 500; by Tailored Chemical Products, Inc.; Hickory, NC; (800) 627-1687.
   2. CoreFoam Insulation, by CoreFoam, Inc.; Knoxville, TN; (800) 656-3626
   3. R-501 Polymaster Plastic Foam Insulation; by PolyMaster, Inc.; Knoxville, TN; (800) 580-3626.
   4. Rapco Blue; by JESCO, Inc.; Florence, SC; (843) 665-5350.
   5. Thermco Foam; by Thermal Corp. of America; Mt. Pleasant, IA; (319) 385-1535.
   6. Tripolymer Foam Insulation; by C.P. Chemical Co., Inc.; White Plains, NY; (914) 428-2517.
   7. Substitutions: None accepted.

B. Expanded polystyrene bead type loose or blown fill insulation shall not be used.

PART 3 - EXECUTION

3.1 PREPARATION

A. Verify items provided by other sections of work are properly sized and located.

B. Establish lines, levels, and coursing. Protect from disturbance. Use non-corrosive materials in contact with masonry work.
C. Provide temporary bracing for walls, lintels, and other masonry work during erection. Maintain in place until roof and other structural elements are complete and provide permanent bracing.

D. Provide temporary bracing for walls, lintels, and other masonry work during erection.
   1. Design bracing in accordance with MCAA Standard Practice for Bracing Masonry Walls Under Construction.
   2. Design bracing under supervision of an independent Professional Engineer hired by the contractor and licensed in the state in which the project is located.
   3. Maintain in place until roof and other structural elements are complete and provide permanent bracing.

E. Wetting of Brick: Wet brick before laying if initial rate of absorption exceeds 30 g/30 sq. in. per minute when tested in accordance with ASTM C 67. Allow units to absorb water until damp but not wet at time of laying.

3.2 COURSING

A. Place masonry to lines and levels indicated.

B. Maintain masonry courses to uniform width. Make vertical and horizontal joints equal and of uniform thickness.

C. Lay concrete masonry units in running bond unless otherwise noted. Course one block unit and one mortar joint to equal 8 inches (4 inches for half high units).

D. Tool head and bed joints concave when mortar is thumbprint hard regardless if below grade or above ceiling height. Use tool with large enough radius that joint is not raked free of mortar.

E. Lay brick in running bond

3.3 PLACING AND BONDING

A. Lay solid concrete masonry units with completely filled bed and head joints; butter ends with sufficient mortar to fill head joints and shove into place. Do not slush head joints. Remove excess mortar.

B. For hollow concrete masonry units, fill head and bed joints solidly with mortar for a distance in from the face of the unit not less than the thickness of the shell. Bed webs in mortar in starting course on footings and foundation walls and in courses of piers, columns and pilasters, and where adjacent to cells or cavities to be reinforced or filled with concrete or grout. For starting courses on footings, spread out full mortar bed, including areas under cells.

C. Fully bond intersections, and external and internal corners.

D. Do not shift or tap masonry units after mortar has taken initial set. Where adjustment must be made, remove mortar and replace.

E. Perform jobsite cutting with proper tools to provide straight unchipped edges. Take care to prevent breaking masonry unit corners or edges.
   1. Where required, match finish masonry work to adjacent surfaces.
   2. For fire-rated walls, construct walls to finish against bottom of roof or floor deck and fill voids with firestopping.
   3. For other than fire-rated walls, cut units to match the slope of the roof deck and finish construction to within 2 inches of and parallel to roof deck.
F. Isolate masonry partitions from vertical structural framing members with a control joint.

G. Fire Rated Construction: Install masonry to comply with designated UL assembly without diminishing structural requirements.

3.4 TOLERANCES

A. Construct masonry within the following tolerances:
   1. Alignment of Pilasters: Maximum 1/4 inch from true line.
   2. Variation from Plane of Wall: 1/4 inch in 10 feet; 3/8 inch in 20 feet; 1/2 inch maximum.
   3. Variation from Plumb: 1/4 inch per story non-cumulative.
   4. Variation from Level Coursing: 1/8 inch in 3 feet; 1/4 inch in 10 feet; 1/2 inch maximum.
   5. Variation of Joint Thickness: 1/8 inch in 3 feet.
   6. Variation from Unit to Adjacent Unit: 1/32 inch maximum.

B. Tolerances for the placement of reinforcing steel in walls and flexural elements:
   1. ± 1/2 inch when the distance from the centerline of the steel to the opposite face of the masonry, "d", is equal to 8 inches or less.
   2. ± 1 inch for "d" equal to 24 inches or less but larger than 8 inches.
   3. ± 1-1/4 inch for "d" greater than 24 inches.

3.5 REINFORCEMENT AND ANCHORAGES

A. Install horizontal joint reinforcement 16 inches on center, or where otherwise indicated on Drawings. Place joint reinforcement continuous in first and second joint below top of walls. Lap joint reinforcement ends minimum 6 inches. Do not extend joint reinforcement through control joints.
   1. Coordinate installation of veneer anchors

B. Set vertical reinforcing bars supported and secured against displacement by means of bar positioners prior to placing grout. Set and support other bars, anchor bolts, and embedded items and tie to prevent displacement prior to placing grout.

C. Grout cells full that contain vertical reinforcing. Use low lift grout method of construction conforming to requirements of ACI 530/ASCE 5/TMS.

D. Place grout barrier below reinforced bond beams as required to prevent grout falling through cells while maintaining positive bond in mortar joint.

E. Verify that anchorages embedded in masonry are properly placed.
   1. Proper placement of embed anchors shall be full depth penetration of scheduled anchorage without contact of embed stud with interior surface of exterior shell face.

F. After reinforcing of masonry is securely tied in place, plug cleanout holes with masonry units. Brace against wet grout pressure.

3.6 MASONRY FILL INSULATION

A. Confirm that selected foam insulation material is compatible and non-detrimental to referenced fire resistance assemblies before use.

B. Install insulation in masonry unit cores of exterior walls.

C. Non Formaldehyde Forming Foamed-In-Place Insulation:
1. Installer shall be certified and/or approved by manufacturer of insulation. Install foam insulation in strict accordance with manufacturer's published instructions.
2. Pump foam insulation bored into mortar joints around entire wall area 3 feet from floor level. Repeat at height no greater than ten feet until completion of wall area.
3. Plug holes with mortar after completion.

3.7 LINTELS
A. Install loose steel lintels as scheduled.
B. Install reinforced unit masonry lintels over openings where steel lintels are not scheduled. Construct lintels using grout fill and reinforcing. Maintain minimum 8 inch bearing on each side of opening, unless noted otherwise on Drawings.
C. Use reinforcing bars of one piece lengths only.
D. Place and consolidate grout fill without disturbing reinforcing. Allow lintels to reach strength before removing temporary supports.
E. For soap units covering steel lintels, provide 9 gage Z-ties at each vertical joint. Weld Z-ties to web of steel lintel.

3.8 CONTROL JOINTS
A. Do not continue bond beam reinforcing (except at floor and roof levels and top of walls) or joint reinforcing across control joints unless otherwise shown on the Drawings.
B. Install preformed control joint filler at locations indicated on Drawings. Use proper size material to create sealant joint space. For backer rod and sealant see Section 07900.

3.9 BUILT-IN WORK
A. As work progresses, build in metal door frames, fabricated metal frames, window frames, anchor bolts, diaphragm anchors, embedded plates, and other items included in the work supplied by other Sections. Masonry Reglet: Install reglet level and parallel to building lines. Set reglet as indicated to coordinate with sloped roof surface.
B. Install items plumb and level.
C. Bed anchors of metal door and glazed frames in mortar joints. Fill frame voids solid with grout or mortar. Fill masonry cores with grout minimum 12 inches from framed openings.
D. Do not build in organic materials subject to deterioration.

3.10 CUTTING AND FITTING
A. Cut and fit for bearing plates, chases, pipes, conduit, sleeves, and grounds. Coordinate with other Sections of work to provide correct size, shape, and location.
B. Obtain approval prior to cutting or fitting any area not indicated or where appearance or strength of masonry work may be impaired.
3.11 CLEANING

A. In-Progress Cleaning: Clean unit masonry as work progresses by dry brushing to remove mortar fins and smears before tooling joints.

B. Final Cleaning: After mortar is thoroughly set and cured, clean exposed masonry as follows:
   1. Remove large mortar particles by hand with wooden paddles and nonmetallic scrape hoes or chisels.
   2. Protect non-masonry surfaces from contact with cleaner by covering them with liquid strippable masking agent, polyethylene film, or waterproof masking tape.
   3. Clean non-colored CMU masonry with a proprietary acidic cleaner applied according to manufacturer's written instructions.
   4. Clean integral colored CMU with a non-acidic proprietary cleaner applied according to manufacturer's written instructions.
   5. Clean brick with a non-acidic proprietary cleaner applied to manufacturers written instructions.
   6. Cleaned surfaces shall appear as represented by mockup wall panel.

C. Remove excess mortar and smears. Replace defective mortar. Match adjacent work.

D. Clean soiled surfaces with a non-acidic solution which will not harm masonry or adjacent materials. Consult masonry manufacturer for acceptable cleaners.

E. Use non-metallic tools in cleaning operations.

3.12 PROTECTION

A. Maintain protective boards at exposed external corners which may be damaged by construction activities.

B. Provide protection without damaging completed work.

C. Protect the base of walls from rain-splashed mud and mortar droppings.

D. At day's end, cover unfinished walls to prevent moisture infiltration. Weight cover down to prevent blow-off and maintain protection for fresh masonry work. Extend cover from top of wall a minimum of 2 feet down the wall on each side.

3.13 FIELD QUALITY CONTROL

A. Engage the services of an independent testing agency to perform the following testing for field quality control.

B. Testing Frequency: Tests and Evaluations listed in this Article will be performed during construction for each 5000 sq. ft. (460 sq. m) of wall area or portion thereof.

C. Mortar properties will be tested per property specification of ASTM C 270.

D. Mortar composition and properties will be evaluated per ASTM C 780.

E. Grout will be sampled and tested for compressive strength per ASTM C 1019.
F. Evaluation of Quality-Control Tests: In the absence of other indications of noncompliance with requirements, masonry will be considered satisfactory if results from construction quality-control tests comply with minimum requirements indicated.

3.14 MASONRY WASTE DISPOSAL

A. Recycling: Undamaged, excess masonry materials are Contractor's property and shall be removed from the Project site for his use.

B. Excess Masonry Waste: Remove excess, clean masonry waste that cannot be used as fill, and other masonry waste and legally dispose of off Owner's property.

END OF SECTION
PART 1 - GENERAL

1.01 DESCRIPTION

A. Work includes, but is not necessarily limited to:

1. Furnishing all labor, materials, tools and equipment necessary for the fabrication and erection of new structural steel in accordance with the Contract Drawings and these Specifications.
2. Furnish loose and miscellaneous items, such as: anchor bolts, bearing plates, weld plates, etc., not specified in other sections.

B. Work related, but specified elsewhere includes:

1. Miscellaneous Metals.
2. Grouting of Bearing Plates.
3. Field Painting.
4. Steel Joist
5. Steel Deck.

1.02 QUALITY ASSURANCE

A. The design, fabrication and erection of all structural steel work shall be subject to the published standards listed hereinafter as they apply:

2. AISC Code of Standard Practice for Steel Buildings and Bridges.
4. In case of a conflict between the referenced specification and the project specification, the project specification shall govern.

B. All fabrication of structural steel shall be done in shop acceptable to the Architect.

C. All welding shall be performed by welders certified in accordance with the provisions of the AWS.

1.03 SUBMITTALS

A. Shop Drawings:

1. Prior to submission of shop drawings to the Architect for review, Fabricator is responsible for verifying existing conditions.
2. Submit shop drawings to the Architect for review a minimum of 10 working days prior to start of fabrication.
3. Shop drawings shall give complete information necessary for the fabrication of the component parts of the structure including the location, type and size of all bolts and welds.

B. Certificates: in lieu of testing of structural steel for conformance to applicable material specifications.
1.04 PRODUCT DELIVERY, STORAGE AND HANDLING

A. Delivery: structural steel delivered to the site shall have erection marks painted on the member to conform with the shop or erection drawings.

B. Storage: structural steel shall be stored above ground on skids or other supports. Material shall be properly covered and protected from corrosion.

C. Handling:

1. Care shall be taken to avoid bending, scraping and overstressing the steel. Projecting parts likely to be bent and injured shall be either blocked with wood or otherwise protected from injury. All pieces bent or otherwise injured will be rejected.

2. Long girders or trusses shall be loaded and marked so that when delivered to the site they may be handled without turning.

PART 2 - MATERIALS

2.01 MATERIALS

All material shall be new and without imperfections.

A. Structural Steel:
   a. Wide Flange Shapes – A992
   b. All other rolled shapes – A36

B. Bolts:
   1. High strength bolts, ASTM A325.

C. Galvanizing: ASTM A123.

D. Welding Electrodes:
   1. Electrodes shall conform to the requirement of ASW Dl.I.
   2. Electrodes shall be compatible with the base metal in accordance with Table 1.5.3 and 1.17.2A of the AISC Specifications specified in Article 1.2.A.1 of this Section.

E. Structural Tubing: ASTM A500, Grade B, Fy=46ksi.

F. Welded and seamless steel pipe: ASTM A53, Grade B.

G. Paint Primer: Federal Specification TT-P-86G, Type II.
2.02 FABRICATION

Fabrication of structural steel shall be performed in accordance with the applicable sections of the AISC Specification and Code of Standard Practice for Steel Buildings and Bridges specified in Article 1.02.A.1 of this section.

3.00 INSTALLATION

3.01 FIELD QUALITY CONTROL

A. High strength bolt installation: ASTM A325.

B. If, in the opinion of the Architect the quality of the material of workmanship is not in conformance with these specifications and contract drawings, the material or erected assembly may be rejected. Cost of removal and replacement of acceptable material or correction of unacceptable workmanship shall be the responsibility of the contractor.

3.02 ERECTION

A. Structural steel shall be erected accurately to the lines and grades indicated on the contract drawings and in accordance with Section 7 of the AISC Code of Standard Practice for Steel Buildings and Bridges.

B. Prior to beginning erection of structural steel, the contractor shall verify the elevation and location of foundations and anchor bolts and that they are ready to receive the steel work.

C. Connectors:
   1. As the erection progresses, the work shall be securely bolted, or welded, to take care of all dead load, wind and erection stresses.
   2. All surfaces within three inches of any field weld location shall be free of materials which would prevent proper welding or produce objectionable fumes while welding is being performed.
   3. Contact surfaces of connections shall be free of oil, grease and other foreign material before assembly and shall not be painted.
   4. High strength bolted connections are slip critical and shall be installed in standard holes and in accordance with ASTM A325.
   5. Load indicator devices may be used to verify the fastener tension for high strength bolts in lieu of the verification procedures specified in ASTM A325. Load indicator devices shall be installed in accordance with ASTM A325, 8(D)(4).

D. Cutting, Punching and Drilling:
   1. No field cutting, punching or drilling of structural members shall be permitted without prior approval of the Architect.
   2. All punching required for attachment of work by other trades to the structural
steel work shall be coordinated with the fabricator and performed in the fabrication shop.

E. Finishing: compression joints depending upon contact bearing shall have the bearing surfaces prepared to a common place by milling, sawing or other suitable means.

F. Bracing: provide temporary bracing wherever necessary to take care of all loads to which the structure may be subjected including, dead loads, wind and erection stresses. Such bracing shall be left in place as long as may be required for safety.

3.03 INSPECTION

A. Examine surface schedule to receive structural steel for:

1. Defects that will adversely affect the execution and quality of the work.
2. Deviations beyond allowable tolerances for installation of structural steel.

B. Do not start work until unsatisfactory conditions are corrected.

END OF SECTION
PART 1 GENERAL

1.1 DESCRIPTION

A. This section describes the design, fabrication, transportation and erection of steel bar joists for this project.

B. Related work: Shall include structural steel, miscellaneous metals, concrete masonry and concrete.

1.2 QUALITY

A. Governing codes and standards:

1. Steel Joist Institute (SJI):


B. Inspection of each member, joist and weld of each joist shall be made before shipment by the shop superintendent or shop inspector. The manufacturer shall ship with each delivery of joists a certification that each and every member, joint, and weld of each joist in that shipment is constructed and fabricated within AISC and AWS Standards such that each joist in that shipment will individually carry the load set forth in the SJI load tables.

1.3 SUBMITTALS

A. Submit shop drawings for all members, for review.

B. Submit copies of mill test reports identifying steel types used in members.

C. Submit certifications as described under Section 1.2B.

1.4 PROCEDURES

A. Written approval from the Architect is required before field reaming or cutting of any shop fabricated steel joist is permitted.

B. Employ, in both shop and field, welders holding current certification in the type of welding in which they will be engaged. Certifications older than 6 months shall not be considered current unless it is shown that the welder has been engaged in the type of welding required for a significant part of the period elapsed. The architect's decision shall be final in making such determinations.
C. Fabrication may proceed only from shop drawings bearing the Architect's stamp and designated "No Exceptions Taken" or "Exceptions Noted."

1.5 TESTING

The required service shall be performed by a testing laboratory selected by the Architect and paid for by the Owner. When inspected work is found to be defective, the cost of such inspection and retesting shall be at no cost to the Owner.

PART 2 MATERIALS

2.1 MATERIALS

A. Steel grades shall conform to SJI Specifications.

B. Welding filler metals shall conform to AWS D1.1 and shall be matched to the steel grades used in accordance with AWS D1.179, Part 4. If steel grade used is not covered by AWS Specifications, manufacturer shall submit analysis and welding technique specifications prepared by a registered professional engineer specializing in metallurgical engineering.

C. Shop paint shall conform to SJI standards.

2.2 FABRICATION

All members shall be cambered in conformance with the SJI recommended camber table listed in SJI Specifications.

2.3 DESIGN

A. Manufacturer shall design joists for resultant net uplift in addition to gravity and load capacities required by load tables.

B. Top or bottom chords shall be designed to carry point loads that do not occur directly over panel points where condition occurs.

PART 3 INSTALLATION

3.1 ERECTION:

A. Members shall be delivered to the site and handled in a manner to prevent overstressing of sections, prying action on weld joints, reduction camber, or the incurring of sweep into the members.

B. Each section shall be inspected upon delivery to the job-site. No section having any broken or cracked weld or crimped or bent member shall be erected on the structure. The discovery of any such defects in erected joists will require complete replacement of the joists at no costs to the Owner.
C. Erection and installation of bridging shall be in accordance with the design drawings and SJI Specifications and shall be installed prior to the placement of any temporary or permanent deck or slab loads on the structure.

D. Members framing directly to or over columns shall have erection bolted connections.

E. Touch up all welded or damaged surfaces with primer matching the shop coat.

3.2 FIELD INSPECTIONS

A. Welding and bolting to supports ad anchoring of bridging shall be inspected at a rate to be determined by consultation between the Architect and the testing laboratory.

B. Visually inspect shop welded joints for consistency of weld volume and quality. Report results to the Architect.

END OF SECTION
1.0 GENERAL

1.1 DESCRIPTION

A. Work includes, but is not necessarily limited to:

1. Furnishing all labor, materials, tools and equipment necessary for the fabrication and erection of metal decking in accordance with the Contract Drawings and these Specifications.

2. Furnish all loose and miscellaneous items such as: closure strips, ridge and valley plates, roof sump pans, welding washers, etc., not specified in other sections.

B. Work related but specified elsewhere includes:

1. Miscellaneous metals.

2. Field painting.


1.2 QUALITY ASSURANCE

A. Codes and Standards:

Comply with the provisions of the following codes and standards, except as otherwise shown or specified:

a. AISI "Specification for the Design of Cold Formed Steel Structural Members."

b. AWS "Structural Welding Code." AWS D1.3.

c. SDI Publication No. 28 - Steel Deck Institute Design Manual for Composite Decks, Form Decks, Roof Decks.


B. Qualification of Welding Work:

1. Welders employed on the work shall have passed qualification test within the past 12 months in the position for which qualified, using test procedures covered in the AWS D1.1.

2. Contractor shall require any welder to retake the qualification test when, in the opinion of the Architect, the work of the welder creates a reasonable doubt as to the proficiency of the welder. Re-qualification tests shall be conducted at no additional expense to the Owner. Re-certification shall be made to Architect after the welder has passed the pretest.
3. Each shop and field welder shall be assigned an identifying symbol, and all
welds made by him shall be so identified.

1.3 PERFORMANCE REQUIREMENTS

A. Compute the properties of metal deck section on the basis of the effective design
width as limited by the provisions of the AISI Specifications. Provide not less than
the deck section properties shown, including section modules and moment of
inertia per foot of width.

B. Allowable Deflection: design and fabricate deck for a maximum deflection of
1/240 of the clear span under the total uniform dead and live load.

C. Uplift Loading: install and anchor roof deck units to resist net uplift loading of 15
lbs. per sq. ft. for roof areas, unless indicated otherwise on drawings.

1.4 SUBMITTALS

A. Product data: Submit manufacturer's produce description and installation
instructions. Indicate deck configurations, weights and structural characteristics.

B. Shop Drawings: indicate decking layout and framing details dimensions, cuts,
and holes and connections to adjacent members. Indicate welding patterns, with
weld symbols in accord with standard AWS welding symbols.

C. Welder qualifications: Submit evidence that welders employed in the work are
currently certified under AWS qualification procedures.

1.5 DELIVERY, STORAGE AND HANDLING

Store metal deck with one end elevated for drainage. Reject materials which are
damaged or corroded.

2.0 MATERIALS

2.1 MATERIALS

A. Steel with a minimum yield strength of 33000 psi. ASTM A446, Grade A, B, C, D,
E, or F, or ASTM A611, Grade C, D, or E.

B. Miscellaneous Steel Shapes: ASTM A36.

C. Galvanizing: ASTM A525, G690 (0.90 oz. per sq. ft.)

D. Galvanizing Repair Paint: high zinc-dust content for repair of damaged
galvanized surfaces complying with Military Specifications MIL-P-21035 (Ships).

D. Flexible Closure Strips for Deck: manufacturer's standard closed-cell, synthetic rubber.

2.2 FABRICATION

A. General: form deck units in lengths to span 3 or more supports with flush, telescoped or nested 2" end laps and nesting side laps, unless otherwise indicated. Provide deck configurations complying with SDI "Basic Design Specifications," and as specified herein.

B. Roof Sump Pans: fabricate from a single piece of not less than 14 gage galvanized sheet steel of the same quality as the deck units; with level bottoms and sloping sides to direct water flow to the drain, unless otherwise shown. Provide sump pans of adequate size to receive roof drains and with bearing flanges not less than 3" wide. Recess panes not less than 1~" below the roof deck surface, unless otherwise shown or required by deck configuration. Holes for drains will be cut in the field.

C. Ridge and Valley Plates: fabricate ridge and valley plates of galvanized sheet steel of the same quality as the deck units; each leg not less than 2%" wide, bent to provide tight-fitting closure with deck units. Provide plates in 10' lengths where possible.

D. Metal Closure Strips: fabricate metal closure strips of not less than 20 gage galvanized sheet steel of the same quality as the deck units. Form to the configuration required to provide tight-fitting closures at open ends and sides of decking.

3.0 INSTALLATION

3.1 INSPECTION

Installer must examine the areas and conditions under which metal decking items are to be installed and notify in writing of conditions detrimental to the proper and timely completion of the work. Do not proceed with the work until unsatisfactory conditions have been corrected in a manner acceptable to the Installer.

3.2 INSTALLATION

A. General: Install deck units and accessories in accordance with manufacturer's recommendations and final shop drawings, and as specified herein. Deck units shall be installed prior to installation of any concrete or masonry supported on structural steel beams.
B. Placing Deck Units:

1. Place deck units on supporting steel framework and adjust to final position with ends bearing on supporting members and accurately aligned end to end before being permanently fastened. Lap ends not less than 2". Do not stretch or contract the side-lap interlocks. Place deck units flat and square, secured to adjacent framing without warp or excessive deflection. Do not place deck units on any concrete supporting structure until concrete has cured properly and is dry.

2. Coordinate and cooperate with structural steel erector in locating decking bundles to prevent overloading of structural members. Do not use deck units for storage or working platforms until permanently secured.

C. Fastening Deck Units:

1. Unless noted on drawings, permanently fasten deck units to steel supporting members by not less than 1/2" diameter fusion welds, or elongated welds of equal strength, not more than 12" o.c. at supports.
2. Use welding washers for welding deck thinner than 22 gage to steel supporting members.
3. Comply with AWS requirements and procedures for manual shielded metal arc welding, the appearance and quality of welds, and the methods used in correcting welding work.
4. Unless noted on drawings, provide a minimum lock of side laps between adjacent deck units at intervals not exceeding 36" o.c. by welding, button punching, or screws.
5. When shown on drawings, fastening of deck units shall be governed by data shown on drawings.

D. Cutting and Fitting: Cut and fit deck units and accessories around other work projecting through or adjacent to the decking, as shown on the drawings. Provide neat, square and trim cuts.

E. Reinforcement at Openings:

1. Provide additional metal reinforcement and closure pieces as required for strength, continuity of decking and support of other work, unless otherwise shown.
2. Reinforce decking around openings less than 15" in any dimension by means of a flat steel sheet placed over the opening and fusion welded to the top surface of the deck. Provide steel sheet of the same quality as the deck units, not less than 20 gage, and at least 12" wider and longer than the opening. Provide welds at each corner and spaced not more than 12" o.c. along each side.

F. Roof Sump Pans: place roof sump pans over openings provided in the roof decking and weld to the top decking surface. Space welds not more than 12" o.c.
with at least one weld at each corner. Cut opening in the bottom of the roof sump to accommodate the drain size indicated.

G. Ridge and Valley Plates: weld ridge and valley plates to the top surface of the roof decking. Lap end joints not less than 3”, with the laps made in the direction of water flow.

H. Closure Strips: provide metal closure strips at all open uncovered ends and edges of roof decking, and in the voids between decking and other construction.

I. Roof Insulation Support: provide metal closure strips for the support of roof insulation where the rib openings in the top surface of roof decking occur adjacent to edges and openings. Weld closure strips into position.

J. Touch-up Painting:

1. After decking installation, wire brush, clean and paint scarred areas, welds and rust spots on the top and bottom surfaces of decking units and supporting steel members.
2. Touch-up galvanized surfaces with galvanizing repair paint applied in accordance with the manufacturer’s instructions.
3. In areas where touch-up painted surfaces are to be exposed, apply the paint to blend into the adjacent surfaces in a manner that will minimize visual discontinuity in the coatings.

END OF SECTION
PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Load bearing formed steel stud exterior and interior framing 20 gage and heavier.
   2. Cold formed steel C-shaped joists.
   3. Cold formed steel ceiling joists.
   4. Cold formed steel stud header wall framing and bracing supported from roof structure.
   5. Cold formed deep leg track (capture track) for interior nonload-bearing steel stud partitions.

B. Related Sections:
   1. Section 06100 - Rough Carpentry: Wood furring strips, plywood, and blocking.
   2. Section 09250 - Gypsum Board: Non-load bearing steel stud partition framing 20 gage and lighter and gypsum board attached to cold formed metal framing.

1.2 REFERENCES

A. The publications listed below form a part of this specification to the extent referenced. Publications are referenced within the text by the basic designation only.

B. American Iron and Steel Institute (AISI):
   a. North American Specification for the Design of Cold-Formed Steel Structural Members.
   b. Standard for Cold-Formed Steel Framing

C. ASTM International (ASTM):
   a. ASTM A 153 - Zinc Coating (Hot-Dip) on Iron and Steel Hardware.
   b. ASTM A 653 - Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.
   c. ASTM A 1003 - Steel Sheet, Carbon, Metallic- and Nonmetallic-Coated for Cold-Formed Framing Members
   d. ASTM C 954 - Steel Drill Screws for the Application of Gypsum Board or Metal Plaster Bases to Steel Studs from 0.033 in. (0.84 mm) to 0.112 in (2.84 mm) in Thickness.
   e. ASTM C 1007 - Installation of Load Bearing (Transverse and Axial) Steel Studs and Related Accessories.
   f. ASTM C 1513 - Steel Tapping Screws for Cold-Formed Steel Framing Connections.

D. American Welding Society (AWS):
   a. AWS D1.3 - Structural Welding Code - Steel Sheet.

E. Gypsum Association (GA):
   a. GA-216 - Application and Finishing of Gypsum Board.

F. Steel Structures Painting Council (SSPC):
   a. SSPC-Paint 20 - Zinc-Rich Coating Type I Inorganic And Type II Organic.

G. Steel Stud Manufactures Association (SSMA):
   a. SSMA Product Technical Information.

1.3 SUBMITTALS

A. Shop Drawings for Prefabricated Wood Trusses:
   1. Indicate profile of framing to be used; pitch, span, camber, spacing, and layout for each type of truss required.
2. Indicate type, size, material, finish, design value, and location of connections.
3. Indicate bearing and anchorage details.
4. Indicate truss hanger manufacturer, manufacturer's designation and maximum load capacity for all wood hangers supporting trusses.
5. Indicate all bracing and bridging sizes, locations and connections.

B. Calculations shall be signed and sealed by a licensed Professional Structural Engineer in State in which project is located. A copy of the calculations shall be kept on file by the truss fabricator.

C. Shop drawings shall be prepared under the direct supervision of a licensed Professional Structural Engineer in State in which project is located.

D. Submit Shop Drawings and Calculations within 30 working days of Contract date.

1.4 QUALITY ASSURANCE

A. Installer Qualifications: Company specializing in the installation of cold formed metal framing components with minimum five years documented experience.

B. Install system to provide for movement of components without damage, failure of joint seals, undue stress on fasteners, or other detrimental effects when subject to seasonal or cyclic day/night temperature ranges.

C. Install system to accommodate construction tolerances, deflection of building structural members, and clearances of intended openings.

D. Qualifications for Welding Work: Qualify welding operators in accordance with Standard Qualification Procedures as required by AWS D1.1.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Section 01600 - Product Requirements: Transport, handle, store, and protect products.

B. Protect metal framing from corrosion, deformation, and other damage during delivery, storage, and handling.

C. Store and protect with waterproof covering; ventilate to avoid condensation.

D. Where framing is stored outdoors, stack materials off ground, supported on level platform, fully protected from weather.

PART 2 PRODUCTS

2.1 MATERIALS

A. Comply with AISI North American Specification for the Design of Cold-Formed Steel Structural Members and ANSI Standard for Cold-Formed Steel Framing.

B. Steel Sheet: ASTM A 1003, Structural Grade, Type H, metallic coated, Grade: ST33H (33 ksi) unless otherwise indicated, Coating G60.

C. Material Thickness: Gage shown on the drawings shall have the following minimum base metal thickness.
   1. 20 gage: 33 mils
2. 18 gage: 43 mils
3. 16 gage: 53 mils

D. Interior and Exterior Load-Bearing Studs: Manufacturer's standard C-shaped steel studs, of web depths indicated, punched, with stiffened flanges, depth, flange width, and gage as indicated on Drawings.

a. Interior and Exterior Load-Bearing Steel Joists: Manufacturer's standard C-shaped steel joists, of web depths indicated, with stiffened flanges.

E. Partition Floor Tracks and Runners: Galvanized sheet steel, C-shaped; same depth and gage as studs; tight fit; solid web.

F. Steel Track: Manufacturer's standard U-shaped steel track, of web depths indicated, unpunched, with unstiffened flanges, and same minimum base-metal thickness as steel studs.

G. Deflection (Capture) Track: Deep-leg, U-shaped steel track; unpunched, with unstiffened flanges, of web depth as shown to contain studs while allowing free vertical movement, with flanges or legs as shown designed to support horizontal and lateral loads. Provide fasteners as indicated on Drawings.

1. Contractor's Option: Manufacturer's standard double or single deflection track as follows:
   a. VertiClip or VertiTrack by The Steel Network, Raleigh, NC (888) 474-4876. If this option is used, track may be 20 gage for all stud sizes.
   b. FastTop Clip by Dietrich Metal Framing, Pittsburg, PA (412) 281-2805.
   c. SLP-TRK by Brady Innovations as distributed by Dietrich Metal Framing.

H. Wall Furring and Partition Bracing: Galvanized sheet steel.

1. Cold-Rolled Channels: 3/4 inch x 1/2 inch and 1-1/2 inch x 17/32 inch or as shown on the drawings.
2. Clip Angles: 2 inches x 2 inches x 16 gage x 1/4 inch less than stud width or
   a. Bridge Clip by The Steel Network.
   b. EasyClip U-Series Clip Angles 1-1/2" x 1-1/2" x 16 gage x 1/4 inch less than stud width by Dietrich Metal Framing.

3. Contractor’s Option: In lieu of cold rolled channels and clip angles for horizontal bridging, provide one of the following:
   a. Bridge Bar by the Steel Network.
   b. TradeReady Spazzer 5400 or 9200 bridging and spacing bar by Dietrich Metal Framing.

I. Framing Attachment Angles: Galvanized sheet steel, size, shape and configuration as indicated on Drawings, 14 gage, unless indicated otherwise on Drawings.

1. Contractor’s Option: Contact Dietrich Clip Express (330) 372-5564 for alternative selections.


K. Flat Metal Straps and Plates: Galvanized sheet steel, gage, shape, and configuration as indicated on Drawings.

1. Contractor’s Option: In lieu of 2-inch continuous metal strap at capture tracks, Contractor may provide one of the following:
   a. Bridge Bar by The Steel Network.
   b. TradeReady Spazzer 5400 bridging and spacing bar by Dietrich Metal Framing

2.2 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 10
times design load.

B. Mechanical Fasteners: ASTM C 1513, corrosion-resistant-coated, self-drilling, self-tapping steel drill screws.

C. Framing to Framing: ASTM C 1513; 5/8 inch Type S-12 low-profile head corrosion-resistant self-drilling self-tapping steel screws.

D. Framing to Attachment Angle Fasteners: #12 diameter pan head corrosion-resistant self-drilling self-tapping steel screws.

E. Wall Floor Track Anchorage Device: Carbon steel wedge type expansion anchor; minimum 3/8 inch diameter x minimum 1-1/2 inch embedment.
   1. Kwik Bolt KB II 38-3, by Hilti, Tulsa, OK (800) 879-8000.

F. Wall Furring to Concrete or Masonry Wall Fasteners: Hex head sleeve anchors; minimum 1/4 inch diameter x minimum 1-1/8 inch embedment.
   1. Slv Anch HX 5/16X2-1/2, by Hilti or equal.
   2. Dynabolt HN-1413, by ITW Ramset/Redhead or equal.

G. Furring Channel to Masonry or Concrete Surface Fasteners: Low velocity powder-actuated drive pins of size to suit application.

H. Welding Materials: AWS D1.3.

I. Wood Furring, Blocking, and Plywood, Attached to Framing Fasteners: Specified in Section 06100.

2.3 FRAMING ACCESSORIES

A. Fabricate steel-framing accessories from steel sheet, ASTM A 1003, Structural Grade, Type H, metallic coated, of same grade and coating weight used for framing members, unless otherwise indicated.

B. Steel Shapes and Clips: ASTM A 36, zinc coated by hot-dip process according to ASTM A 123.

2.4 FINISHES

A. Galvanizing: G60 coating class.

B. Galvanizing Repair Paint: SSPC-Paint 20, Type II - organic.

PART 3 EXECUTION

3.1 EXAMINATION

A. Examine existing conditions and adjacent areas where products will be installed and verify that conditions conform to product manufacturer's requirements. Verify that building framing components are ready to receive work. Verify that rough-in utilities are in-place and located where required. Do not proceed until unsatisfactory conditions have been corrected.

B. Beginning of erection indicates acceptance of existing conditions.

3.2 INSTALLATION, GENERAL
A. Install cold-formed metal framing in accordance with AISI Standard for Cold-Formed Steel Framing and to manufacturer's written instructions unless more stringent requirements are shown or specified.

B. Install cold-formed metal framing and accessories plumb, square, and true to line, and with connections securely fastened.

C. Install framing members in one-piece lengths.

3.3 INSTALLATION - STUD FRAMING

A. Install studs and fasteners in accordance with manufacturer's published instructions and, where gypsum board is attached to studs, install studs in accordance with GA-216 and ASTM C 1007.

B. Metal Stud Spacing: 16 inches on center, maximum, unless otherwise shown on the drawings.

C. Align stud web openings horizontally.

D. Construct corners using minimum three studs.

E. Place studs as indicated on Drawings, minimum 2 inches from abutting walls.

F. Erect studs one piece full length. Splicing of studs not permitted.

G. Erect studs, brace, and reinforce to develop full strength to meet design requirements.

H. Install headers at partition openings using load-bearing C-shaped joists.

I. Install framing between studs for attachment of mechanical and electrical items.

J. Coordinate placement of insulation in multiple stud spaces made inaccessible after erection.

K. Install intermediate studs above and below openings to match wall stud spacing.

L. Fasten studs adjacent to door and window frames, partition intersections, and corners to top and bottom runner flanges in double-stud fashion with metal lock fastener tools.
   1. Securely fasten studs to jamb and head anchor clips of door and borrowed-light frames.
   2. Place horizontally a cut-to-length section of runner with web-flange bent at each end, fasten with minimum one screw per flange.
   3. Position a cut-to-length stud (extending to top runner) at vertical panel joints over door frame header.

M. Install bridging for stud partitions over 8 feet high at mid-height with 1-1/2 inch rolled channels through studs and screw attach in place using clip angles. Lap channels by nesting one inside the other to a length of at least 8 inches and wire fasten together.

N. Blocking: Screw attach wood blocking between studs. Install blocking for support of plumbing fixtures, toilet partitions, wall cabinets, toilet accessories, and hardware.

O. Where optional framing products by the named manufacturers are specified in Part 2 above in lieu of conventional components specified, install in accordance with manufacturers recommendations.

P. Touch up field welds and damaged galvanized surfaces with primer.

Q. Fastening: Fasten framing in accordance with manufacturer's published instructions and
schedule below unless indicated otherwise on Drawings.

<table>
<thead>
<tr>
<th>FASTENERS</th>
<th>MINIMUM CONNECTION</th>
</tr>
</thead>
<tbody>
<tr>
<td>Floor Track to Concrete</td>
<td>1 Anchor at 36 inches on center.</td>
</tr>
<tr>
<td>Partition Stud to Floor Track</td>
<td>1 Screw each side at flange.</td>
</tr>
<tr>
<td>Stud Web to Stud Web</td>
<td>2 Screws.</td>
</tr>
<tr>
<td>Plates and Straps to Studs</td>
<td>2 Screws.</td>
</tr>
<tr>
<td>Lateral Bracing to Partition Stud Using clip</td>
<td>2 Screws to stud and 2 Screws to cold rolled channel.</td>
</tr>
<tr>
<td>Angles</td>
<td></td>
</tr>
<tr>
<td>Runner to Header</td>
<td>1 Screw at 16 inches on center, maximum 6 inches from each end.</td>
</tr>
<tr>
<td>Welded Connections</td>
<td>Indicated on Drawings.</td>
</tr>
</tbody>
</table>

3.4 INSTALLATION - JOIST FRAMING

A. Install joists and fasteners in accordance with manufacturer's published instructions.
B. Make provisions for erection stresses. Provide temporary alignment and bracing.
C. Place joists at locations and spacing as indicated on Drawings.
D. Touch-up field welds and damaged galvanized surfaces with primer.
E. Fastening: Indicated on Drawings.

3.5 INSTALLATION - CEILING JOISTS

A. Install joists and fasteners in accordance with manufacturer's published instructions and, where gypsum board is attached to joists, install joists in accordance with GA-216, and ASTM C 1007.
B. Ceiling Joist Spacing: 16 inches on center beginning from center of room unless otherwise shown on the drawings.
C. Install joists in direction of shortest span, parallel and level, with lateral bracing and bridging.
D. Install joists in one piece full length. Splicing of joists not permitted.
E. Install perimeter joist runner track sized to match joists. Attach joist runner track to wall framing with minimum 2 screws per stud and at corners and ends.
F. Attach joist ends to joist runner tracks with minimum 1 screw each side at each flange.
G. Install bridging at 48 inches on center beginning from center of room with 1-1/2 inch rolled channels screw attached to joists.

3.6 INSTALLATION - FURRING

A. Furring Channels: Attach vertically spaced at maximum 16 inches on center, unless otherwise shown on the drawings, to masonry and concrete surfaces with specified powder driven fasteners staggered 24 inches on center on opposite flanges.
B. Wall Furring:
   1. Secure top and bottom runners to structure.
2. Space metal furring at maximum 16 inches on center unless otherwise shown on the drawings.

3.7 CONSTRUCTION

A. Interface with Other Work:
   1. Coordinate erection of studs with hollow metal door frames.
   2. Coordinate installation of anchors, supports, and blocking for mechanical, electrical, and building accessory items installed within framing.

B. Perform field welding in accordance with AWS D1.3.

3.8 QUALITY ASSURANCE TESTING AND INSPECTION

A. Engage the services of an independent testing agency to perform the following inspections for field quality control.

B. Welding (General):
   1. Prior to start of fabrication, determine if fabrication shop meets the criteria for exempting shop welds from inspection and confirm in writing to building official and SER.
   2. Verify qualifications of all welders as AWS certified.
   3. Verify proposed welding procedures and materials.
   5. Verify preheat and interpass temperatures of steel, proper technique and sequence of welding, and cleaning and number of passes are provided as required.

C. Welding (Field):
   1. Cold Formed Metal Framing Welds: Visually inspect 100% of welds for specified length, size, and continuity in accordance with AWS D1.3 for metal less than 1/8" in thickness, for work designed as a structural element.
   2. Miscellaneous Metals, Inserts and Prefabricated Components: Where integrity of the connections impact life safety or performance of the building structure, provide testing and inspection as for typical welds previously specified.

D. Miscellaneous Mechanical Fasteners: Visually inspect specified size, spacing, embedment, and location that are part of the building structural system.

E. Submittal Verification: Verify mill test reports and other submitted documentation for compliance with contract documents.

F. Material Verification: Verify materials delivered to site comply with contract documents and approved shop drawings. Materials include:
   1. Bolts
   2. Electrodes
   3. Mechanical fasteners

G. Verification of Detail Compatibility:
   1. Inspect on a periodic basis:
   2. Review project documents affecting integrity of the structure including contract documents and approved shop drawings.
   3. Visit site at intervals appropriate to the stage of construction to perform review of the structure and visually confirm general compliance with the contract documents.
   4. Inspect the following to verify that member orientation, configuration, type, and size comply with details indicated on the contract documents and approved shop drawings:
      a. Bracing and stiffening members.
      b. Proper applications of joint details at connections for structural members.
      c. Other work critical to the integrity of the building structure.
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 1 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes the following metal fabrications:
   1. Miscellaneous framing and supports for the following:
      a. Applications where framing and supports are not specified in other sections.
   2. Miscellaneous steel trim, including the following:
      a. Steel angle corner guards.
      b. Bollards.

1.3 SUBMITTALS

A. General: Submit each item in this Article according to the Conditions of the Contract and Division 1 Specification Sections.

B. Qualification data for firms and persons specified in the "Quality Assurance" Article to demonstrate their capabilities and experience.

1.4 QUALITY ASSURANCE

A. Fabricator Qualifications: Firm experienced in producing metal fabrications similar to those indicated for this Project with a record of successful in-service performance, and with sufficient production capacity to produce required units without delaying the Work.

   1. Certify that each welder has satisfactorily passed AWS qualification tests for welding processes involved and, if pertinent, has undergone recertification.

1.5 PROJECT CONDITIONS

A. Field Measurements: Check actual locations of walls and other construction to which metal fabrications must fit by accurate field measurements before fabrication. Show recorded measurements on final shop drawings. Coordinate fabrication schedule with construction progress to avoid delaying the Work.

   1. Where field measurements cannot be made without delaying the Work, guarantee dimensions and proceed with fabricating products without field measurements. Coordinate construction to ensure that actual dimensions correspond to guaranteed dimensions. Allow for trimming and fitting.

PART 2 - PRODUCTS

2.1 FERROUS METALS

A. Metal Surfaces, General: For metal fabrications exposed to view in the completed Work, provide materials selected for their surface flatness, smoothness, and freedom from surface
blemishes. Do not use materials with exposed pitting, seam marks, roller marks, rolled trade names, or roughness.

B. Steel Plates, Shapes, and Bars: ASTM A 36 (ASTM A 36M).

C. Rolled Steel Floor Plates: ASTM A 786 (ASTM A 786M).

D. Steel Tubing: Product type (manufacturing method) and as follows:
   1. Cold-Formed Steel Tubing: ASTM A 500.
   2. Hot-Formed Steel Tubing: ASTM A 501.
      a. For exterior installations and where indicated, provide tubing with hot-dip galvanized coating per ASTM A 53.

E. Steel Pipe: ASTM A 53, standard weight (schedule 40), unless otherwise indicated, or another weight required by structural loads.
   1. Black finish, unless otherwise indicated.
   2. Galvanized finish for exterior installations and where indicated.


H. Cast-in-Place Anchors in Concrete: Anchors of type indicated below, fabricated from corrosion-resistant materials capable of sustaining, without failure, the load imposed within a safety factor of 4, as determined by testing per ASTM E 488, conducted by a qualified independent testing agency.
   1. Threaded or wedge type; galvanized ferrous castings, either ASTM A 47 (ASTM A 47M) malleable iron or ASTM A 27 (ASTM A 27M) cast steel. Provide bolts, washers, and shims as required, hot-dip galvanized per ASTM A 153.

I. Welding Rods and Bare Electrodes: Select according to AWS specifications for the metal alloy to be welded.

2.2 PAINT

A. Shop Primer for Ferrous Metal: Fast-curing, lead- and chromate-free, universal modified-alkyd primer complying with performance requirements of FS TT-P-664, selected for good resistance to normal atmospheric corrosion, compatibility with finish paint systems indicated, and capability to provide a sound foundation for field-applied topcoats despite prolonged exposure.

B. Galvanizing Repair Paint: High-zinc-dust-content paint for regalvanizing welds in galvanized steel, with dry film containing not less than 94 percent zinc dust by weight, and complying with DOD-P-21035 or SSPC-Paint 20.

C. Bituminous Paint: Cold-applied asphalt mastic complying with SSPC-Paint 12, except containing no asbestos fibers.

2.3 FASTENERS

A. General: Provide plated fasteners complying with ASTM B 633, Class Fe/Zn 25 for electrodeposited zinc coating, for exterior use or where built into exterior walls. Select fasteners for the type, grade, and class required.
B. Bolts and Nuts: Regular hexagon-head bolts, ASTM A 307, Grade A (ASTM F 568, Property Class 4.6), with hex nuts, ASTM A 563 (ASTM A 563M), and, where indicated, flat washers.

C. Machine Screws: ANSI B18.6.3 (ANSI B18.6.7M).

D. Lag Bolts: ANSI B18.2.1 (ANSI B18.2.3.8M).

E. Wood Screws: Flat head, carbon steel, ANSI B18.6.1.


H. Expansion Anchors: Anchor bolt and sleeve assembly of material indicated below with capability to sustain, without failure, a load equal to 6 times the load imposed when installed in unit masonry and equal to 4 times the load imposed when installed in concrete as determined by testing per ASTM E 488 conducted by a qualified independent testing agency.


2. Material: Group 1 alloy 304 or 316 stainless-steel bolts and nuts complying with ASTM F 593 (ASTM F 738M) and ASTM F 594 (ASTM F 836M).

I. Toggle Bolts: FS FF-B-588, tumble-wing type, class and style as required.

2.4 GROUT

A. Nonshrink, Nonmetallic Grout: Factory-packaged, nonstaining, noncorrosive, nongaseous grout complying with ASTM C 1107. Provide grout specifically recommended by manufacturer for interior and exterior applications.

B. Products: Subject to compliance with requirements, provide one of the following:

1. Nonshrink, Nonmetallic Grouts:
   a. B-6 Construction Grout; W. R. Bonsal Co.
   b. Diamond-Crete Grout; Concrete Service Materials Co.
   c. Supreme; Cormix Construction Chemicals.
   d. Sure-grip High Performance Grout; Dayton Superior Corp.
   e. Euco N-S Grout; Euclid Chemical Co.
   f. Five Star Grout; Five Star Products.
   g. Vibropruf #11; Lambert Corp.
   h. Crystex; L & M Construction Chemicals, Inc.
   i. Masterflow 928 and 713; Master Builders Technologies, Inc.
   j. Sealight 588 Grout; W. R. Meadows, Inc.
   k. Sonoground 14; Sonneborn Building Products--ChemRex, Inc.
   l. Kemset; The Spray-Cure Company.

2.5 FABRICATION, GENERAL

A. Form metal fabrications from materials of size, thickness, and shapes indicated but not less than that needed to comply with performance requirements indicated. Work to dimensions indicated or accepted on shop drawings, using proven details of fabrication and support. Use type of materials indicated or specified for various components of each metal fabrication.
B. Form exposed work true to line and level with accurate angles and surfaces and straight sharp edges.

C. Allow for thermal movement resulting from the following maximum change (range) in ambient temperature in the design, fabrication, and installation of installed metal assemblies to prevent buckling, opening up of joints, and over stressing of welds and fasteners. Base design calculations on actual surface temperatures of metals due to both solar heat gain and nighttime sky heat loss.
   1. Temperature Change (Range): 100 deg F (55.5 deg C).

D. Shear and punch metals cleanly and accurately. Remove burrs.

E. Ease exposed edges to a radius of approximately 1/32 inch (1 mm), unless otherwise indicated. Form bent-metal corners to smallest radius possible without causing grain separation or otherwise impairing work.

F. Remove sharp or rough areas on exposed traffic surfaces.

G. Weld corners and seams continuously to comply with the following:
   1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
   2. Obtain fusion without undercut or overlap.
   3. Remove welding flux immediately.
   4. At exposed connections, finish exposed welds and surfaces smooth and blended so that no roughness shows after finishing, and contour of welded surface matches those adjacent.

H. Form exposed connections with hairline joints, flush and smooth, using concealed fasteners wherever possible. Use exposed fasteners of type indicated or, if not indicated, Phillips flat-head (countersunk) screws or bolts. Locate joints where least conspicuous.

I. Provide for anchorage of type indicated; coordinate with supporting structure. Fabricate and space anchoring devices to secure metal fabrications rigidly in place and to support indicated loads.

J. Shop Assembly: Preassemble items in shop to greatest extent possible to minimize field splicing and assembly. Disassemble units only as necessary for shipping and handling limitations. Use connections that maintain structural value of joined pieces. Clearly mark units for reassembly and coordinated installation.

K. Cut, reinforce, drill, and tap metal fabrications as indicated to receive finish hardware, screws, and similar items.

L. Fabricate joints that will be exposed to weather in a manner to exclude water, or provide weep holes where water may accumulate.

2.6 LOOSE BEARING AND LEVELING PLATES

A. Provide loose bearing and leveling plates for steel items bearing on masonry or concrete construction, made flat, free from warps or twists, and of the required thickness and bearing area. Drill plates to receive anchor bolts and for grouting as required. Galvanize after fabrication.
2.7 LOOSE STEEL LINTELS

A. Fabricate loose structural steel lintels from steel angles and shapes of size indicated for openings and recesses in masonry walls and partitions at locations indicated.

B. Weld adjoining members together to form a single unit where indicated.

C. Size loose lintels for equal bearing of 1 inch per foot (85 mm per m) of clear span but not less than 8 inches (200 mm) bearing at each side of openings, unless otherwise indicated.

D. Galvanize loose steel lintels located in exterior walls.

2.8 MISCELLANEOUS FRAMING AND SUPPORTS

A. General: Provide steel framing and supports for applications indicated that are not a part of structural steel framework as required to complete the Work.

B. Fabricate units to sizes, shapes, and profiles indicated and required to receive other adjacent construction retained by framing and supports. Fabricate from structural steel shapes, plates, and steel bars of welded construction using mitered joints for field connection. Cut, drill, and tap units to receive hardware, hangers, and similar items.

   1. Equip units with integrally welded anchors for casting into concrete or building into masonry. Furnish inserts if units must be installed after concrete is placed.

      a. Except as otherwise indicated, space anchors 24 inches (600 mm) o.c. and provide minimum anchor units in the form of steel straps 1-1/4 inches (32 mm) wide by 1/4 inch (6 mm) thick by 8 inches (200 mm) long.

C. Galvanize miscellaneous framing and supports in the following locations:

   1. Interior locations where indicated.

2.9 MISCELLANEOUS STEEL TRIM

A. Unless otherwise indicated, fabricate units from structural steel shapes, plates, and bars of profiles shown with continuously welded joints, and smooth exposed edges. Miter corners and use concealed field splices wherever possible.

B. Provide cutouts, fittings, and anchorages as required to coordinate assembly and installation with other work. Provide anchors, welded to trim, for embedding in concrete or masonry construction, spaced not more than 6 inches (150 mm) from each end, 6 inches (150 mm) from corners, and 24 inches (600 mm) o.c., unless otherwise indicated.

C. Galvanize miscellaneous steel trim in the following locations:

   1. Exterior locations.
   2. Interior locations where indicated.

2.10 STRUCTURAL STEEL DOOR FRAMES

A. Fabricate steel door frames from structural shapes and bars of size and to dimensions indicated, fully welded together, with 5/8-by-1-1/2-inch (16-by-38-mm) steel bar stops, unless otherwise indicated. Plug-weld built-up members and continuously weld exposed joints. Secure removable stops to frame with countersunk machine screws, uniformly spaced at not more than 10 inches (250 mm) o.c. Reinforce frames and drill and tap as required to accept finish hardware.
B. Provide steel strap anchors for securing door frames into adjoining concrete or masonry, using 1/8-by-2-inch (3-by-50-mm) straps of the length required for a minimum 8-inch (200-mm) embedment, unless otherwise indicated. Weld anchors to frame jambs no more than 12 inches (300 mm) from both bottom and head of frame and space anchors not more than 30 inches (750 mm) apart.

C. Extend bottom of frames to floor elevation indicated with steel angle clips welded to frames for anchoring frame to floor with expansion shields and bolts.

D. Galvanize frames and anchors in the following locations:
   1. Exterior locations.
   2. Interior locations where indicated.

2.11 FINISHES, GENERAL

A. Comply with NAAMM "Metal Finishes Manual" for recommendations relative to applying and designing finishes.

B. Finish metal fabrications after assembly.

2.12 STEEL AND IRON FINISHES

A. Galvanizing: For those items indicated for galvanizing, apply zinc coating by the hot-dip process complying with the following requirements:
   1. ASTM A 153 for galvanizing iron and steel hardware.
   2. ASTM A 123 for galvanizing both fabricated and unfabricated iron and steel products made of uncoated rolled, pressed, and forged shapes, plates, bars, and strip 0.0299 inch (0.76 mm) thick or thicker.

B. Preparation for Shop Priming: Prepare uncoated ferrous metal surfaces to comply with minimum requirements indicated below for SSPC surface preparation specifications and environmental exposure conditions of installed metal fabrications:
   1. Exteriors (SSPC Zone 1B): SSPC-SP 6 "Commercial Blast Cleaning."
   2. Interiors (SSPC Zone 1A): SSPC-SP 3 "Power Tool Cleaning."

C. Apply shop primer to uncoated surfaces of metal fabrications, except those with galvanized finishes or to be embedded in concrete, sprayed-on fireproofing, or masonry, unless otherwise indicated. Comply with requirements of SSPC-PA 1 "Paint Application Specification No. 1" for shop painting.
   1. Stripe paint corners, crevices, bolts, welds, and sharp edges.

PART 3 - EXECUTION

3.1 PREPARATION

A. Coordinate and furnish anchorages, setting drawings, diagrams, templates, instructions, and directions for installing anchorages, including concrete inserts, sleeves, anchor bolts, and miscellaneous items having integral anchors that are to be embedded in concrete or masonry construction. Coordinate delivery of such items to Project site.

3.2 INSTALLATION, GENERAL
A. Fastening to In-Place Construction: Provide anchorage devices and fasteners where necessary for securing miscellaneous metal fabrications to in-place construction. Include threaded fasteners for concrete and masonry inserts, toggle bolts, through-bolts, lag bolts, wood screws, and other connectors as required.

B. Cutting, Fitting, and Placement: Perform cutting, drilling, and fitting required for installing miscellaneous metal fabrications. Set metal fabrication accurately in location, alignment, and elevation; with edges and surfaces level, plumb, true, and free of rack; and measured from established lines and levels.

C. Provide temporary bracing or anchors in formwork for items that are to be built into concrete masonry or similar construction.

D. Fit exposed connections accurately together to form hairline joints. Weld connections that are not to be left as exposed joints but cannot be shop-welded because of shipping size limitations. Do not weld, cut, or abrade the surfaces of exterior units that have been hot-dip galvanized after fabrication and are intended for bolted or screwed field connections.

E. Field Welding: Comply with the following requirements:
1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
2. Obtain fusion without undercut or overlap.
3. Remove welding flux immediately.
4. At exposed connections, finish exposed welds and surfaces smooth and blended so that no roughness shows after finishing, and contour of welded surface matches those adjacent.

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

3.3 SETTING LOOSE PLATES


B. Set loose leveling and bearing plates on wedges or other adjustable devices. After the bearing members have been positioned and plumbed, tighten the anchor bolts. Do not remove wedges or shims, but if protruding, cut off flush with the edge of the bearing plate before packing with grout.
   1. Use nonshrink, nonmetallic grout in all locations, unless otherwise indicated.
   2. Pack grout solidly between bearing surfaces and plates to ensure that no voids remain.

3.4 INSTALLING PIPE BOLLARDS

A. Anchor pipe bollards in concrete with pipe sleeves preset anchored into concrete. After setting bollard, fill annular space between bollard and sleeve solidly with non-shrink grout mixed and placed to comply with manufacturer’s directions.

3.5 ADJUSTING AND CLEANING

A. Touchup Painting: Immediately after erection, clean field welds, bolted connections, and abraded areas of shop paint, and paint exposed areas with same material as used for shop painting to comply with SSPC-PA 1 requirements for touching up shop-painted surfaces.
1. Apply by brush or spray to provide a 2.0-mil (0.05-mm) minimum dry film thickness.

B. For galvanized surfaces, clean welds, bolted connections, and abraded areas, and apply galvanizing repair paint to comply with ASTM A 780.

END OF SECTION
PART 1 GENERAL

1.1 SECTION INCLUDES

A. Aluminum access ladders.

1.2 RELATED SECTIONS

A. Section 05500 – Metal Fabrications: Fasteners and installation requirements used to attach ladders to structure.

1.3 REFERENCES

A. AA – Aluminum Association.
D. OSHA 1910.27 – Fixed Ladders.

1.4 SUBMITTALS

A. Submit under provisions of Section 01330.
B. Product Data: Manufacturer's data sheets on each product.
C. Shop Drawings:
   1. Detail fabrication and erection of each ladder indicated. Include plans, elevations, sections, and details of metal fabrications and their connections.
   2. Provide templates for anchors and bolts specified for installation under other Sections.
   3. Provide reaction loads for each hanger and bracket.
D. Qualification Data:
   1. Refer to Quality Assurance provisions for submittal requirements evidencing experience, certifications and resources.
E. Selection Samples: For each finish specified, two complete sets of color chips representing manufacturer's full range of available colors.
F. Verification Samples: For each finish specified, two samples, minimum size 6 inches (150 mm) square, represent actual product color.
1.5 QUALITY ASSURANCE

A. Manufacturer Qualifications: A firm experienced in producing aluminum metal ladders similar to those indicated for this Project.
   1. Record of successful in-service performance.
   2. Sufficient production capacity to produce required units.
   3. Professional engineering competent in design and structural analysis to fabricate ladders in compliance with industry standards and local codes.

B. Installer Qualifications: Competent and experienced firm capable of selecting fasteners and installing ladders to attain designed operational and structural performance.

C. Product Qualification: Product design shall comply with OSHA 1910.27 minimum standards for ladders.

D. Mock-Up: Provide a mock-up for evaluation of surface preparation techniques and application workmanship.
   1. Install ladder in area designated by Architect.
   2. Do not proceed with remaining work until workmanship and installation are approved by Architect.
   3. Rework mock-up as required to produce acceptable work.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Store products in manufacturer's unopened packaging until ready for installation.

1.7 PROJECT CONDITIONS

A. Field Measurements: Verify dimensions by field measurement before fabrication.
   1. Established Dimensions: Where field measurements cannot be made without delaying the Work, indicate established dimensions on shop drawing submittal and proceed with fabrication.

1.8 WARRANTY

A. Manufacturer has responsibility for an extended Corrective Period for work of this Section for a period of 5 years commencing on the shipment date of the product against all the conditions indicated below, and when notified in writing from Owner, manufacturer shall promptly and without inconvenience and cost to Owner correct said deficiencies.
   1. Defects in materials and workmanship.
   2. Deterioration of material and surface performance below minimum OSHA standards
as certified by independent third party testing laboratory. Ordinary wear and tear, unusual abuse or neglect excepted.

3. Within the warranty period, the manufacturer shall, at its option, repair, replace, or refund the purchase price of defective ladder.

B. Manufacturer shall be notified immediately of defective products, and be given a reasonable opportunity to inspect the goods prior to return. Manufacturer will not assume responsibility, or compensation, for unauthorized repairs or labor. Manufacturer makes no other warranty, expressed or implied, to the merchantability, fitness for a particular purpose, design, sale, installation, or use, of the ladder; and shall not be liable for incidental or consequential damages, losses of or expenses, resulting from the use of ladder products.

1.9 EXTRA MATERIALS

A. Furnish touchup kit for each type and color of paint finish provided.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Acceptable Manufacturer:

1. O’Keeffe’s, Inc.; 100 N Hill Drive, Suite 12, Brisbane, CA 94005. Toll Free Tel: (888) 653-3333. Tel: (415) 824-4900. Fax: (415) 824-5900. Email: info@okeeffes.com. Web: http://www.okeeffes.com.

2. ALACO Ladder Co.; 5167 G Street, Chino, CA 91710-5143. Tel: (888) 310-7040 Fax (909) 591-7565. E-mail: sales@alacoladder.com Web: www.alacoladder.com


C. Substitutions: Not permitted.

D. Requests for substitutions will be considered in accordance with provisions of Section 01600.

2.2 APPLICATIONS/Scope

A. Fixed and Cage Ladder Design:

1. Safety cages are required on ladders over 24 feet (7315 mm)

2. Safety cages are required on all ladders in high or hazardous areas.

3. Landing platforms are required at 50 feet (15,240 mm) above the bottom of the ladder.

B. Fixed Access Ladder:
1. Tubular Rail Low Parapet Access Ladder with Platform and Return.
   a. Model 503 as manufactured by O’Keeffe’s Inc.
   b. Model 563 as manufactured by ALACO Ladder Co.
   c. Model ELLSBAD as manufactured by Royalite Manufacturing, Inc.

2.3 FINISHES

A. Mill finish. As extruded.

B. Clear Anodic Finish: AA-M10C22A41 Mechanical finish as fabricated. Architectural Class I, clear coating 0.018 mm or thicker.

2.4 MATERIALS

A. Aluminum Sheet: Alloy 5005-H34 to comply with ASTM B209.

B. Aluminum Extrusions: Alloy 6061-T1 or 6063-T6 to comply with ASTM B221.

2.5 FABRICATION

A. Rungs: Not less than 1-1/4 inches (32 mm) in section and 18–3/8 inches (467mm) long, formed from tubular aluminum extrusions. Squared and deeply serrated on all sides.

   1. Rungs shall withstand a 1,500 pound (454 kg) load without deformation or failure.

B. Channel Side Rails: Not less than 1/8 inch (3 mm) wall thickness by 3 inches (76 mm) wide.

C. Heavy Duty Tubular Side Rails: Assembled from two interlocking aluminum extrusions no less than 1/8 inch (3 mm) wall thickness by 3 inches (76 mm) wide. Construction shall be self-locking stainless steel fasteners, full penetration TIG welds and clean, smooth and burr-free surfaces.

D. Walk-Through Rail and Roof Rail Extension: Not less than 3 feet 6 inches (1067 mm) above the landing and shall be fitted with deeply serrated, square, tubular grab rails.

E. Landing Platform: 1-1/2 inches (38 mm) or greater diameter, tubular aluminum guardrails and decks of serrated aluminum treads.

F. Security Doors: Formed 1/8 inch (3 mm) thick aluminum sheet. Security panels shall extend on both sides, perpendicular to the door face, to within 2 inches (51 mm) of the wall. Security door shall be furnished with continuous aluminum piano hinge and heavy duty forged steel locking hasps.

G. Ship Ladder Seismic Bottom Support: Manufacturer’s standard; two isolation bearings per stringer.

H. Ladder Safety Post: Retractable hand hold and tie off.
I. Rail and Harness Fall Arrest System: Supplied where specified as alternate to safety cage and landing platforms, in accordance with OSHA regulation 1910.27; permanently mounted to ladder rungs and complete with necessary components.

J. Safety Cages:
   1. Fabricate ladder safety cages to comply with authority having jurisdiction. Assemble by welding. Spacing of primary hoops, secondary hoops and vertical bars shall not exceed that required by code.
   2. Safety cage hoops and vertical bars: 3/16 inch (5 mm) by 2 inches (51 mm) aluminum bar.

PART 3 EXECUTION

3.1 EXAMINATION
   A. Coordinate anchorages. Furnish setting drawings, templates, and anchorage structural loads for fastener resistance.
   B. Do not begin installation until supporting structure is complete and ladder installation will not interfere with supporting structure work.
   C. If supporting structure is the responsibility of another installer, notify Architect of unsatisfactory supporting work before proceeding.

3.2 INSTALLATION
   A. Install in accordance with manufacturer's instructions and in proper relationship with adjacent construction.

3.3 PROTECTION
   A. Protect installed products until completion of project.
   B. Touch-up, repair or replace damaged products before Substantial Completion.

END OF SECTION
PART I – GENERAL

1.1 SUMMARY:

A. Section includes:
   1. Stainless steel countertops and splashes.
   2. Supplementary parts and components, such as clips, fasteners, supplementary Framing, and other miscellaneous accessories required for a complete installation.

B. Related work:
   1. Division 6 for millwork and casework.
   2. Division 7 for joint sealants.

1.2 SYSTEM DESCRIPTION:

A. Design requirements: Engineer, fabricate, assemble and install stainless steel countertops, including attachment to their supports, to meet or exceed the criteria indicated and specified, to conform to the profiles indicated and to other requirements of the Contract Documents.

1.3 SUBMITTALS:

A. Shop drawings:
   1. Submit large scale, dimensioned drawings showing materials, profiles, joints, finishes, method of fabrication and anchorage details. Label individual components and indicate materials and method of field installation.

   2. Indicate layout, methods of support, connection details, integration of plumbing components, and interface and anchorage to adjacent materials. Show position of openings required, with rough-in sizes.

1.4 QUALITY ASSURANCE:

A. Fabricator’s qualifications: Firm and individuals with a minimum of 5 consecutive years experience in the fabrication and installation of specified materials on projects similar in material, design and whose work has resulted in applications with a record of successful in-service performance.

1.5 HANDLING

A. Handling: Deliver stainless steel countertop fabrications as factory-assembled units with protective crating and covering.

B. Storage: Store materials indoors, off the floor in original packaging and protected with breathing type covers.

PART 2 – PRODUCTS
2.1 MANUFACTURERS
   A. Acceptable manufacturers: Provide one of the following or approved equivalent
      1. Stainless Supply: Tel: 877.484.0088, Fax: 866.430.3134; website: www.stainlesssupply.com
      2. Eagle Group: Tel: 800-637-5100, Fax: 302-653-2065; website: www.eaglegrp.com
      3. Stainless Steel Kitchens Inc.: Tel: 574-272-2530; website: stainlesssteelkitchen.com

2.2 MATERIALS
   A. General: Provide materials from a single source.
      1. Provide sheet metals selected for their surface flatness, smoothness and freedom from
         surface blemishes where exposed to view in the finished unit.
      2. Exposed surfaces which exhibit pitting, seam marks, roller marks, oil-canning, stains,
         discolorations, variations in flatness exceeding those permitted by referenced standards
         for stretcher-leveled metal sheets, or other imperfections are unacceptable.
   B. Stainless Steel: Complying with the following.
      1. Bars and shapes ASTM A 276, Type 304.
      2. Sheet, strip, plate, and bar: ASTM A 666, Type 304 or ASTM A 167-81-A, Type 304.
      3. Gage(s) for sheets: Except where noted on the drawings, as necessary for the required
         spans and use intended without visible deflection, oil-canning and other defects.
         a. Countertops, tabletops, and back splashes: 14 ga
      4. Profiles: 1 1/2"
         a. Square edge with return
         b. Bullnose
         c. Marine edge with return
      5. Blacksplash: 1” deep x 4” high integrated backslash
   C. Fasteners:
      1. Of same basic metal and alloy as fastened metal. Do not use corrosive metals or
         incompatible materials on metal joints.
      2. Provide concealed fasteners for interconnection of sheet metal fabrications and for their
         attachment to other construction, unless otherwise accepted on shop drawings.
   D. Backer Materials:
      1. Wood: Provide one of the following
         a. 1 1/2" MDF backer board, constructed of (2) 3/4" layers.
         b. Plywood meeting requirements of sections 06100.
      2. Steel: Provide one of the following
         a. 16 ga Type 304 Stainless steel channels with sound deadening material.
         b. Galvanized steel hat channels with sound deadening material.
      3. Sound deadening material: Non-absorbent, hard drying sound deadening compound for
         permanent adhesion to metal that does not chip, flake, or blister in 1/8” thickness
         Aquaplas F-120A, gray, or approved equivalent.
E. Welding electrodes and filler metal:

1. Type and alloy of filler metal and electrodes recommended by producer of metal to be welded, complying with applicable AWS specifications, and as required for strength and compatibility in the fabricated items.

2. All welding shall conform to national and state requirements and related Specifications, and be performed by certified technicians. Exposed welds shall be continuous, filed or ground smooth and flush, and polished to match adjacent surfaces. Use methods that minimize distortion and develop strength and corrosion resistance base metal.

3. Welds shall be free from gas holes, pits, cracks, dis-colorization and other imperfections.

4. Provide full penetration welds for full-joint length. Welded joints shall be butt fitted, properly jigged, flat continuous, ground smooth and polished for exposed conditions.

5. Where soldering is desirable, it shall be made with tin-lead solder. In no case shall soldering be relied upon for the stability of the seam or joint. Soldering shall serve only as a filler to prevent leakage, and shall not be considered as a replacement for welding or brazing.

6. Butt joints made by spot welding or riveting straps under seams and filling with Solder, puddle welds and exposed screws are not acceptable.

7. Exposed dimples from welding studs on underside of tops other surfaces is not acceptable. Polish surface to match and blend with adjacent surfaces.

8. Welds on galvanized steel shall be smooth and strong. Remove all slag and carbonization. Where galvanizing has been burned off, touch up on both sides with high grade aluminum paint.

9. Use filler metals and welding procedures which will blend with and match the color of sheet metal being joined and will prevent discoloration at welds.

F. Miscellaneous materials: As specified and as necessary to complete this work.

2.3 FABRICATION

A. Comply with AWS D-1.1 “Code for Welding in Building Construction”, except as modified by the Drawings and Specifications.

B. Fabricate countertops to comply with requirements indicated for design, dimensions, materials, joinery and performance.

C. Coordinate dimensions and attachment methods with those of adjoining construction to produce integrated assemblies with closely fitting, flush joints, and edges and surfaces aligned with one another in relationship indicated.

D. Increase metal thickness or reinforce metal with concealed stiffeners or backing materials, or both, as required to produce surfaces whose variations in flatness do not exceed those permitted by referenced standards for stretcher-leveled metal sheet and to impart sufficient strength for intended use.
E. Preassemble countertops in the shop to the greatest extent possible to minimize field splicing and assembly. Disassemble only as necessary for shipping and handling limitations. Clearly mark units for reassembly and coordinated installation.

F. Form to minimize joints and without exposed cut edges.
   1. Fold back exposed ends of unsupported sheet metal to form a ½-inch wide hem on the concealed side, or ease exposed edges with backing to a radius of approximately 1/16-inch.
   2. Produce flat, flush surfaces without cracking and grain separation at bends.

G. Continuously weld joints and seams, except where other methods of joining are indicated or accepted on shop drawings. Grind, fill and dress welds to produce smooth flush exposed surfaces where welds are invisible after final finishing is completed.

H. Provide holes of proper sizes and in correct locations required for attachment of work of other trades.
   1. Cut, tap, and drill as required, including for attachment of work under other Sections.
   2. Finishes free of kinks, twist, burrs and open joints. Damaged or distorted materials will not be allowed.

I. Install supporting members, fastenings, frames, hangers, bracing, brackets, straps, bolts and angles required to set and connect work to other construction.

J. Drill holes for bolts and screws; countersink holes for exposed screws. Provide rebates, lugs and brackets as required by details.

2.4 FINISHING

   A. Provide right, directional polish: NAAMM No. 4 finish or No. 6 Hairline/Matt finish.

   B. When polishing is completed, remove embedded foreign matter and leave surfaces chemically clean.

PART III – EXECUTION

3.1 EXAMINATION

   A. Examine adjacent construction and supports.

   B. Verify condition of stainless steel countertops. Do not install stainless steel countertops with scratches, stains and other defects that may be visible in the finished work.

   C. Correct conditions detrimental to the proper and timely completion of this work before proceeding with installation.

3.2 INSTALLATION
A. Install stainless steel countertops plumb and level, with tight hairline flush joints. Shim as required using concealed shims.

B. Scribe and fit accurately against adjacent surfaces for a close fit.

C. Attach top securely to steel supports with concealed screws as required for a rigid and secure installation.

D. Seal interface of countertops with contiguous surfaces with sealant in compliance with the requirements of Section 07920. Tool sealant uniformly to form a cove and shed water.

3.3 CLEANING

A. After sealant has cured, clean stainless steel countertop with manufacturer’s recommended cleaning material in compliance with manufacturer’s cleaning instructions.

3.4 PROTECTION

A. Protect stainless steel countertops in place during the construction period to prevent damage and stains. Remove protection when no longer needed.

B. Restore damaged areas to match adjacent areas as recommended by the stainless steel countertop manufacturer.

C. Remove and replace materials that are damaged, scratched, have been stained, that do not match adjacent countertops or cannot be satisfactorily cleaned or repaired, as determined and directed by the Customer.

D. Seal interface of countertops with contiguous surfaces with sealant in compliance with the requirements of Section 07920. Tool sealant uniformly to form a cove and shed water.

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 1 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes the following:

1. Framing with dimension lumber.
2. Rooftop equipment bases and support curbs.
3. Wood furring, grounds, nailers, and blocking.
4. Sheathing.

1.3 DEFINITIONS

A. Rough Carpentry: Carpentry work not specified in other Sections and not exposed, unless otherwise specified.

1.4 SUBMITTALS

A. General: Submit each item in this Article according to the Conditions of the Contract and Division 1 Specification Sections.

B. Product Data for the following products:

1. Underlayment.
2. Insulating sheathing.
3. Air-infiltration barriers.
4. Joists or framing members.
5. Metal framing anchors.

C. Material certificates for dimension lumber specified to comply with minimum allowable unit stresses. Indicate species and grade selected for each use and design values approved by the American Lumber Standards Committee's (ALSC) Board of Review.

D. Wood treatment data as follows, including chemical treatment manufacturer's instructions for handling, storing, installing, and finishing treated materials:

1. For each type of preservative-treated wood product, include certification by treating plant stating type of preservative solution and pressure process used, net amount of preservative retained, and compliance with applicable standards.
2. For waterborne-treated products, include statement that moisture content of treated materials was reduced to levels indicated before shipment to Project site.

3. For fire-retardant-treated wood products, include certification by treating plant that treated materials comply with specified standard and other requirements as well as data relative to bending strength, stiffness, and fastener-holding capacities of treated materials.

E. Material test reports from a qualified independent testing agency indicating and interpreting test results relative to compliance of fire-retardant-treated wood products with requirements indicated. Submittal of reports to comply with Division 1 sections.

F. Warranty of chemical treatment manufacturer for each type of treatment.

G. Research or evaluation reports of the model code organization acceptable to authorities having jurisdiction that evidence the following products' compliance with building code in effect for Project.
   1. Engineered wood products.
   2. Foam-plastic sheathing.
   3. Air-infiltration barriers.
   4. Metal framing anchors.
   5. Power-driven fasteners.

1.5 QUALITY ASSURANCE

A. Testing Agency Qualifications: To qualify for approval, an independent testing agency must demonstrate to Architect's satisfaction, based on evaluation of agency-submitted criteria conforming to ASTM E 699, that it has the experience and capability to satisfactorily conduct the testing indicated without delaying the Work.

B. Single-Source Responsibility for Engineered Wood Products: Obtain each type of engineered wood product from one source and by a single manufacturer.

C. Single-Source Responsibility for Fire-Retardant-Treated Wood: Obtain each type of fire-retardant-treated wood product from one source and by a single producer.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Keep materials under cover, dry and elevated above surface on which they are stored. Protect from weather and contact with damp or wet surfaces. Stack lumber, plywood, and other panels. Provide for air circulation within and around stacks and under temporary coverings.

   1. For lumber and plywood pressure treated with waterborne chemicals, place
spacers between each bundle to provide air circulation.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers Compliance: Manufacturers used for this project shall comply with provisions of the American Recovery and Reinvestment Act of 2009.

B. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

C. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Wood-Preservative-Treated Materials:
   b. Chemical Specialties, Inc.
   c. Continental Wood Preservers, Inc.
   d. Hickson Corp.
   e. Hoover Treated Wood Products, Inc.
   f. Osmose Wood Preserving, Inc.
   g. Or approved equal

2. Fire-Retardant-Treated Materials, Exterior Type:
   a. American Wood Treaters, Inc.
   b. Hoover Treated Wood Products, Inc.
   d. Or approved equal.

3. Gypsum Sheathing Board:
   a. Domtar Gypsum.
   b. Georgia-Pacific Corp.
   c. National Gypsum Co.; Gold Bond Building Products Division.
   d. United States Gypsum Co.
   e. Or approved equal

4. Extruded Cellular Polystyrene Sheathing:
   a. Amoco Foam Products Co.
   b. Dow Chemical Company (The).
c. UC Industries, Inc.
d. Or approved equal

5. Polyisocyanurate Foam Sheathing:
   a. Celotex Corporation (The); Building Products Division.
   b. NRG Barriers, Inc.
   c. Rmax, Inc.
   d. Or approved equal.

6. Air-Infiltration Barriers:
   a. Amoco Foam Products Co.
   b. Anthony Industries, Inc.; Simplex Products Division.
   c. Celotex Corporation (The); Building Products Division.
   d. DuPont Company; Fibers Department.
   e. Parsec, Inc.
   f. Raven Industries, Inc.
   g. Reemay, Inc.
   h. Sto-Cote Products, Inc.
   i. Or approved equal

7. Metal Framing Anchors:
   a. Cleveland Steel Specialty Co.
   b. Harlen Metal Products, Inc.
   c. Silver Metal Products, Inc.
   d. Simpson Strong-Tie Company, Inc.
   e. Southeastern Metals Manufacturing Co., Inc.
   f. Or approved equal

2.2 LUMBER, GENERAL


B. Inspection Agencies: Inspection agencies, and the abbreviations used to reference them, include the following:

1. NELMA - Northeastern Lumber Manufacturers Association.
2. NLGA - National Lumber Grades Authority (Canadian).
3. SPIB - Southern Pine Inspection Bureau.
4. WCLIB - West Coast Lumber Inspection Bureau.
5. WWPA - Western Wood Products Association.

C. Grade Stamps: Provide lumber with each piece factory marked with grade stamp of inspection agency evidencing compliance with grading rule requirements and
identifying grading agency, grade, species, moisture content at time of surfacing, and mill.

1. For exposed lumber, furnish pieces with grade stamps applied to ends or back of each piece, or omit grade stamps and provide grade-compliance certificates issued by inspection agency.

D. Where nominal sizes are indicated, provide actual sizes required by DOC PS 20 for moisture content specified. Where actual sizes are indicated, they are minimum dressed sizes for dry lumber.

1. Provide dressed lumber, S4S, unless otherwise indicated.
2. Provide dry lumber with 19 percent maximum moisture content at time of dressing for 2-inch nominal (38-mm actual) thickness or less, unless otherwise indicated.
3. Provide lumber with 15 percent maximum moisture content at time of dressing for 2-inch nominal (38-mm actual) thickness or less, unless otherwise indicated.

2.3 WOOD-PRESERVATIVE-TREATED MATERIALS

A. General: Where lumber or plywood is indicated as preservative treated or is specified to be treated, comply with applicable requirements of AWPA C2 (lumber) and AWPA C9 (plywood). Mark each treated item with the Quality Mark Requirements of an inspection agency approved by ALSC’s Board of Review.

1. Do not use chemicals containing chromium or arsenic.
2. For exposed items indicated to receive stained finish, use chemical formulations that do not bleed through, contain colorants, or otherwise adversely affect finishes.

B. Pressure treat aboveground items with waterborne preservatives to a minimum retention of 0.25 lb/cu. ft. (4.0 kg/cu. m). After treatment, kiln-dry lumber and plywood to a maximum moisture content of 19 and 15 percent, respectively. Treat indicated items and the following:

1. Wood cants, nailers, curbs, equipment support bases, blocking, stripping, and similar members in connection with roofing, flashing, vapor barriers, and waterproofing.
2. Wood sills, sleepers, blocking, furring, stripping, and similar concealed members in contact with masonry or concrete.
3. Wood framing members less than 18 inches (460 mm) above grade.
4. Wood floor plates installed over concrete slabs directly in contact with earth.

C. Pressure treat wood members in contact with ground or freshwater with waterborne preservatives to a minimum retention of 0.40 lb/cu. ft. (6.4 kg/cu. m).

D. Complete fabrication of treated items before treatment, where possible. If cut after
treatment, apply field treatment complying with AWPA M4 to cut surfaces. Inspect each piece of lumber or plywood after drying and discard damaged or defective pieces.

2.4 FIRE-RETARDANT-TREATED MATERIALS

A. General: Where fire-retardant-treated wood is indicated, comply with applicable requirements of AWPA C20 (lumber) and AWPA C27 (plywood). Identify fire-retardant-treated wood with appropriate classification marking of UL; U.S. Testing; Timber Products Inspection, Inc.; or another testing and inspecting agency acceptable to authorities having jurisdiction.

1. Research or Evaluation Reports: Provide fire-retardant-treated wood acceptable to authorities having jurisdiction and for which a current model code research or evaluation report exists that evidences compliance of fire-retardant-treated wood for application indicated.

2. For exposed items indicated to receive stained finish, use chemical formulations that do not bleed through, contain colorants, or otherwise adversely affect finishes.

B. Interior Type A: For interior locations, use chemical formulation that produces treated lumber and plywood with the following properties under conditions present after installation:

1. Bending strength, stiffness, and fastener-holding capacities are not reduced below values published by manufacturer of chemical formulation under elevated temperature and humidity conditions simulating installed conditions when tested by a qualified independent testing agency.

2. No form of degradation occurs due to acid hydrolysis or other causes related to treatment.

3. Contact with treated wood does not promote corrosion of metal fasteners.

C. Exterior Type: Use for exterior locations and where required by code.

D. Inspect each piece of treated lumber or plywood after drying and discard damaged or defective pieces.

2.5 MISCELLANEOUS LUMBER

A. General: Provide lumber for support or attachment of other construction, including rooftop equipment curbs and support bases, cant strips, bucks, nailers, blocking, furring, grounds, stripping, and similar members.

B. Fabricate miscellaneous lumber from dimension lumber of sizes indicated and into shapes shown.

C. Moisture Content: 19 percent maximum for lumber items not specified to receive wood preservative treatment.
D. Grade: For dimension lumber sizes, provide No. 3 or Standard grade lumber per ALSC's NGRs (non-grain-raising) of any species. For board-size lumber, provide No. 3 Common grade per NELMA, NLGA, or WWPA; No. 2 grade per SPIB; or Standard grade per NLGA, WCLIB or WWPA of any species.

2.6 CONCEALED, PERFORMANCE-RATED STRUCTURAL-USE PANELS

A. General: Where structural-use panels are indicated for the following concealed types of applications, provide APA-performance-rated panels complying with requirements designated under each application for grade, span rating, exposure durability classification, and edge detail (where applicable).

1. Thickness: Provide panels meeting requirements specified but not less than thickness indicated.


B. Roof Sheathing: APA-rated sheathing.

2.7 FASTENERS

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

1. Where rough carpentry is exposed to weather, in ground contact, or in area of high relative humidity, provide fasteners with a hot-dip zinc coating per ASTM A 153 (2009) or of Type 304 stainless steel.


C. Power-Driven Fasteners: CABO NER-272.

D. Wood Screws: ASME B18.6.1.

PART 3 - EXECUTION

3.1 INSTALLATION, GENERAL

A. Discard units of material with defects that impair quality of rough carpentry and that are too small to use with minimum number of joints or optimum joint arrangement.

B. Set rough carpentry to required levels and lines, with members plumb, true to line, cut, and fitted.

C. Fit rough carpentry to other construction; scribe and cope as required for accurate
fit. Correlate location of furring, nailers, blocking, grounds, and similar supports to allow attachment of other construction.

D. Apply field treatment complying with AWPA M4 to cut surfaces of preservative-treated lumber and plywood.

E. Securely attach rough carpentry work to substrate by anchoring and fastening as indicated, complying with the following:

1. CABO NER-272 for power-driven staples, P-nails, and allied fasteners.
2. Published requirements of metal framing anchor manufacturer.

F. Use common wire nails, unless otherwise indicated. Use finishing nails for finish work. 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; predrill as required.

G. Use hot-dip galvanized or stainless-steel nails where rough carpentry is exposed to weather, in ground contact, or in area of high relative humidity.

H. Countersink nail heads on exposed carpentry work and fill holes with wood filler.

3.2 WOOD GROUNDS, NAILERS, BLOCKING, AND SLEEPERS

A. Install wood grounds, nailers, blocking, and sleepers where shown and where required for screeding or attaching other work. Form to shapes shown and cut as required for true line and level of attached work. Coordinate locations with other work involved.

B. Attach to substrates to support applied loading. Recess bolts and nuts flush with surfaces, unless otherwise indicated. Build into masonry during installation of masonry work. Where possible, anchor to formwork before concrete placement.

C. Install permanent grounds of dressed, preservative-treated, key-beveled lumber not less than 1-1/2 inches (38 mm) wide and of thickness required to bring face of ground to exact thickness of finish material. Remove temporary grounds when no longer required.

3.3 WOOD FURRING

A. Install plumb and level with closure strips at edges and openings. Shim with wood as required for tolerance of finish work.

1. Firestop furred spaces of walls at each floor level and at ceiling with wood blocking or noncombustible materials, accurately fitted to close furred
spaces.

B. Furring to Receive Plywood Paneling: Install 1-by-3-inch nominal- (19-by-63-mm actual-) size furring at 24 inches (610 mm) o.c., horizontally and vertically. Select furring with no knots capable of producing bent-over nails and damage to paneling.

C. Furring to Receive Plywood Paneling: Install 19- by-63-mm actual-size furring at 600 mm o.c., horizontally and vertically. Select furring with no knots capable of producing bent-over nails and damage to paneling.

3.4 WOOD FRAMING, GENERAL


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

C. Install framing members of size and at spacing indicated.

D. Do not splice structural members between supports.

E. Firestop concealed spaces of wood-framed walls and partitions at each floor level and at ceiling line of top story. Where firestopping is not inherent in framing system used, provide closely fitted wood blocks of 2-inch nominal- (38-mm actual-) thickness lumber of same width as framing members.

3.5 INSTALLATION OF STRUCTURAL-USE PANELS


B. Fastening Methods: Fasten panels as indicated below:

1. Combination Subflooring-Underlayment: Glue and nail to framing throughout.
2. Sheathing: Nail to framing.
3. Underlayment: Nail to subflooring.
4. Plywood Backing Panels: Nail or screw to supports.

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 work of this section.

1.2 DESCRIPTION OF WORK
A. Definition: finish carpentry includes carpentry work which is exposed to view, is non-structural, and which is not specified as part of Architectural Woodwork.
B. Architectural woodwork is specified in another Division 6 section.

1.3 QUALITY ASSURANCE
A. Factory mark each piece of lumber and plywood with type, grade, mill and grading agency identification, except omit marking form surfaces to receive transparent finish, and submit mill certificate that material has been inspected and graded in accordance with requirements if it cannot be marked on a concealed surface.

1.4 SUBMITTALS
A. Samples: Submit samples for each species and cut or pattern of finish carpentry.
B. Wood Treatment Data: Submit chemical treatment manufacturer’s instructions for handling, storage, installation and finishing treated materials.

1.5 PRODUCT DELIVERY, STORAGE AND HANDLING
A. Protect finish carpentry materials during transit, delivery, storage and handling to prevent damage, soiling and deterioration.
B. Do not deliver finish carpentry materials, until painting, wet work, grinding and similar operations which could damage, soil or deteriorate woodwork have been completed in installation areas. If due to unforeseen circumstances, finish carpentry materials must be stored in other than installation areas, store only in areas meeting requirements specified for installation areas.

1.6 JOB CONDITIONS
A. Maintain temperature and humidity in installation area required to maintain moisture content of installed finish carpentry with a 1.0% tolerance of optimum moisture content, from date of installation through remainder of construction period. The fabricator of woodwork shall determine optimum moisture content and require temperature and humidity conditions.

PART 2 - PRODUCTS

2.1 WOOD PRODUCT QUALITY STANDARDS
A. Softwood Lumber Standards: Comply with PS 20 and with applicable grading rules of the respective grading and inspecting agency for the species and product indicated.
B. Plywood Standard: Comply with PS 1/ANSI A199.1.
C. Hardwood Lumber Standard: Comply with National Hardwood Lumber Association (NHLA) rules.
D. Hardwood Plywood Standard: Comply with PS 51.

E. Woodworking Standard: Where indicated for a specific product comply with specified provision of the following:
   1. Architectural Woodwork Institute (AWI) "Quality Standards".

2.2 MATERIALS

A. General: Nominal sizes are indicated, except as shown by detailed dimensions. Provide dressed or worked and dressed lumber, as applicable, manufactured to the actual sizes as required by PS 20 or to actual sizes and patterns as shown, unless otherwise indicated.

B. Moisture Content of Softwood Lumber: Provide seasoned (KD) lumber having a moisture content from time of manufacture until time of installation not greater than values required by the applicable grading rules of the respective grading and inspecting agency for the species and product indicated.

C. Moisture Content of Hardwood Lumber: Provide kiln-dried (KD) lumber having a moisture content form time of manufacture until time of installation within the ranges required in the referenced woodworking standard.

D. Lumber for Transparent Finish (Stained or Clear): Use pieces made of solid lumber stock.

E. Lumber for Painted Finish: Use pieces of lumber made of solid lumber stock.

2.3 INTERIOR FINISH CARPENTRY

A. WM/Series Wood Molding Patterns: For stock molding patterns graded under Wood Molding and Millwork Producer Industry WM 4, provide the following grade based on finish indicated and fabricated from any Western softwood species graded and inspected by WWPA.

B. Hardwood Plywood Stock Panels: Provide manufacturer’s stock hardwood plywood panels complying with applicable requirements of PS 51 for species and grade of face veneers and backing, adhesive, construction, thickness, panel size, and finish.
   2. Face Veneer Species: As selected.
   3. Grade: Premium.
   5. Construction: Veneer core.
   8. Panel Size: As selected or shown.
   9. Plywood Type (Water Resistant Capability): Type II (Interior).
   10. Face Pattern: Plain (no grooves) with veneer edge matched within each panel face to comply with type of match required by referenced product standard.

2.4 MISCELLANEOUS MATERIALS

A. Fasteners and Anchorages: Provide nails, screws and other anchoring devices of the type, size, material, and finish required for application indicated to provide secure attachment, concealed where possible, and complying with applicable Federal Specifications.

2.5 WOOD TREATMENT

A. Preservative Treatment (Trt-Wd): Following basic fabrication provide 3 minute dip treatment of
finish carpentry items indicated to receive preservative treatment in 5% solution of pentachlorophenol, with vehicle which will not interfere with finish application and will produce minimum effect upon appearance. Apply brush coat on surfaces cut after treatment.

B. Fire Retardant Treated Wood (FRTW): Where wood is indicated as "FRTW", provide materials complying with applicable standards for pressure impregnation with fire retardant chemicals and with following requirements.
   1. AWPA Standard for Lumber: AWPA C 20 except as otherwise indicated.
   2. AWPA Standard for Plywood: AWPA C 27 except as otherwise indicated.
   3. Surface Burning Characteristics: Provide materials with surface burning characteristics not exceeding those indicated below when tested in accordance with ASTM E 84 for not less than standard time period (10 minutes).
   4. For FRTW wood used in interior application not exposed to relative humidities in excess of 92% use treatment chemicals with reduced hygroscopicity which are non-corrosive to metal fasteners, are non-blooming and permit use of transparent oil-based finishes.
      a. Products: Subject to compliance with requirements, provide one of the following:
         1) "Dricon", Koppers Company, Inc.
         2) "Flameproof LHC", Osmose Wood Preserving Co. of America, Inc.
         3) "Protex", Hoover Universal Wood Preserving Division.
   5. Kiln-dry wood after treatment to a maximum moisture content of 15% for plywood, 19% for lumber.
   6. Inspect each piece of lumber and plywood or each unit of finish carpentry after drying; do not use twisted, warped, bowed or otherwise damaged or defective wood.

PART 3 - EXECUTION

3.1 PREPARATION

A. Condition wood materials to average prevailing humidity conditions in installation areas prior to installing.

B. Backprime lumber for painted finish exposed on the exterior or, where indicated, to moisture and high relative humidities on the interior. Comply with requirements of sections on painting within Division 9 for primers and their application.

3.2 INSTALLATION

A. Discard units of material which are unsound, warped, bowed, twisted, improperly treated, not adequately seasoned or too small to fabricate work with minimum of joints or optimum jointing arrangements, or which are of defective manufacturer with respect to surfaces, sizes or patterns.

B. Install the work plumb, level, true and straight with no distortions. Shim as required using concealed shims. Install to a tolerance of 1/8" in 8.0" for plumb and level countertops; and with 1/16" maximum offset in flush adjoining 1/8" maximum offsets in revealed adjoining surfaces.

C. Scribe and cut work to fit adjoining work, and refinish cut surfaces or repair damaged finish at cuts.

D. Anchor finish carpentry work to anchorage devices or blocking built-in or directly attached to substrates. Secure to grounds, stripping and blocking with countersunk, concealed fasteners and blind nailing as required for a complete installation. Except where prefinished matching fasteners heads are required, use fine finishing nails for exposed nailing, countersunk and filled flush with finished surface, and matching final finish where transparent is indicated.
E. Hardwood Plywood Paneling: Where grain character or color variations are noticeable, select and arrange panels on each wall for best match of adjacent panels. Install with uniform tight joints between panels.
   1. Attach panels to supports with panel adhesive and temporary bracing or fasteners, plus nailing where covered by moldings (if any), in accordance with manufacturer's instructions for concealed fastener installation.

F. Prefinished Hardwood Paneling, Board Type: Install in accordance with manufacturer's instructions for concealed nailing. Arrange in random width pattern suggested by manufacturer, unless boards are of uniform width. Stagger end joints in random pattern for best visual effect (uniformly distributed on each wall). Install with uniform joints, with only tongued and grooved or end matched joints within each field of paneling.

G. Softwood Paneling System, Board Type: Install in accordance with manufacturer's instructions by method indicated below, or if not indicated, as recommended by manufacturer for substrate provided.

3.3 ADJUSTMENT, CLEANING, FINISHING AND PROTECTION

A. Repair damaged and defective finish carpentry work wherever possible to eliminate defects functionally and visually; where not possible to repair properly, replace woodwork. Adjust joinery for uniform appearance.

B. Clean finish carpentry work on exposed and semi-exposed surfaces. Touch-up shop applied finishes to restore damaged or soiled areas.

C. Refer to Division 9 sections for final finishing of installed finish carpentry work.

D. Protection: Installer of finish carpentry work shall advise Contractor of final protection and maintained conditions necessary to ensure that work will be without damage or deterioration at time of acceptance.

END OF SECTION
PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Cabinet Hardware and Accessories.

1.2 REFERENCES

A. The publications listed below form a part of this specification to the extent referenced. Publications are referenced within the text by the basic designation only.

B. American National Standards (ANSI):
   1. ANSI A208.1 - Particleboard
   2. ANSI A208.2 - Medium Density Fiberboard For Interior Use


E. National Electrical Manufacturer's Association (NEMA)
   1. NEMA LD3 - High-Pressure Decorative Laminates

1.3 DELIVERY, STORAGE AND HANDLING

A. Inspect materials delivered and reject those not qualifying with requirements, those damaged in transit, or those that appear otherwise unsatisfactory.

B. Schedule delivery of items to installation areas that are in proper condition to receive them. Place items neatly and systematically to avoid damage, store in clean, dry, enclosed, and secure storage area.

PART 2 - PRODUCTS

2.1 CABINET HARDWARE AND ACCESSORIES

A. Provide cabinet hardware as specified by the following manufacturers:
   1. Knape & Vogt (KV), 2700 Oak Industrial Drive NE, Grand Rapids, MI 49505, (616) 459-3311.
   2. Hafele, 3901 Cheyenne Drive, Archdale, NC 27263, (800) 423-3531.
   3. Ives, 2720 Tobey Drive, Indianapolis, IN 46219, (877) 613-8766.
   5. Blum, Inc., 7733 Old Plank Road, Stanley, NC 28164, (800) 438-6788.

B. Cabinet Hardware:
   1. Wire Drawer and Door Pulls: ANSI/BHMA A156.9, B02011, solid metal, 4 inches long, 5/16 inch in diameter.
   2. Drawer Slides: ANSI/BHMA A156.9, B05091. Slides shall include an integral positive stop to avoid accidental drawer removal.
      a. Box Drawer Slides: Grade 1HD-100; side mounted; full-extension type; zinc-plated steel ball-bearing slides for drawers not more than 6 inches high and 24 inches wide.
b. File Drawer Slides: Grade 1HD-100; side mounted; full-extension type; zinc-plated steel ball-bearing slides for drawers more than 6 inches high or 24 inches wide.
c. Pencil Drawer Slides: Grade 1; side mounted; full-extension type; zinc-plated steel or epoxy-coated steel with polymer rollers for drawers not more than 3 inches high and 24 inches wide.

3. Drawer Locks: ANSI/BHMA A156.11, E07041.

4. Shelf Rests: ANSI/BHMA A156.9, B04013; metal.
   a. Place rests in drilled 5mm diameter holes, spaced vertically at 1 1/4” centers. Minimum of four rests per shelf.
   b. Shelf span per AWI/AWMAC/WI standards.


6. Frameless Concealed Hinges (European Type): ANSI/BHMA A156.9, B01602, 100 degrees of opening, self-closing.

C. Cabinet Accessories: Provide cabinet accessories by the manufacturers specified below or equivalent products of same function, style, material, and finish from manufacturers specified above.
   1. Grommets:
         1) Size as noted on Drawings.
         2) Color as noted on Drawings.
         1) Size as noted on Drawings.
         2) Color as noted on Drawings.
      c. Bainbridge Manufacturing: 2 1/2 inch Round 1031BK-52.
   2. Adjustable Shelf Pin: Hafele #282.40.708 5mm.

D. Exposed Hardware Finishes: For exposed hardware, provide finish that complies with ANSI/BHMA A156.18 for BHMA finish number indicated, except where indicated otherwise.
   1. Satin Chromium Plated: BHMA 626 for brass base; BHMA 652 for steel base; BHMA 682 for zinc base.

E. For concealed hardware, provide manufacturer's standard finish that complies with product class requirements in ANSI/BHMA A156.9.

PART 3 - EXECUTION

3.1 CASEWORK

A. Install woodwork plumb, level, and straight without distortion; use concealed shims. Scribe and cut woodwork to fit adjoining work. Anchor woodwork items to nailers or blocking or directly to substrate using concealed fasteners.

B. Casework: Provide well-fitting and smooth operating doors and drawers.

C. Countertops: Anchor countertops securely to base units.

END OF SECTION
PART 1 - GENERAL

1.1 SUMMARY:

A. Work of this section includes:
   1. Countertops at bars
   2. Lavatory tops with integral sinks.
   3. Window sills.

1.2 REFERENCES:

A. Applicable standards: Standards of the following, as referenced herein:
   1. American National Standards Institute (ANSI)
   2. ASTM International (ASTM)

1.3 SUBMITTALS:

A. Shop drawings: Indicate dimensions, component sizes, fabrication details attachment provisions and coordination requirements with adjacent work.

B. Samples: Submit minimum 6" by 6" samples. Indicate full range of color and pattern variation. Approved samples will be retained as a standard for work.

C. Product data: Indicate product description, fabrication information and compliance with specified performance requirement.

D. Maintenance data: Submit manufacturer's care and maintenance data, including repair and cleaning instructions. Include in project closeout documents.

1.4 QUALITY ASSURANCE:

A. Job mock-up:
   1. Prior to final approval of shop drawings, erect at project site, for Architect's review, one full size mock-up of each component required.
   2. Should mock-up not be approved, re-fabricate and re-install until approval is secured. Remove rejected units from project site.
   3. Approved mock-ups may remain as part of finished work.

1.5 DELIVERY, STORAGE AND HANDLING:

A. Deliver no components to project site until areas are ready for installation. Store indoors.

B. Handle materials to prevent damage to finished surfaces. Provide protective coverings to prevent physical damage or staining following installation for duration of project.

1.6 WARRANTY:

A. Provide manufacturer's warranty against defects in materials. Warranty shall provide for replacement material and labor for a period of ten years, beginning at Date of Substantial Completion.
PART 2 - PRODUCTS

2.1 SOLID SURFACING MATERIAL:

A. Acceptable products:

B. Material: Cast, 100% acrylic resin, solid, structural surfacing material.
   1. Material shall be through-patterned and homogeneous. No coated materials nor non-homogeneous materials allowed.
   3. Tensile strength: Minimum 4,200 psi, tested in accord with ASTM D638—01.
   4. Abrasion resistance: Maximum 0.4 grams at 1,000 cycles, tested in accord with ASTM C501—84 (2002)
   5. Fire resistance: Flame spread and smoke developed meeting ASTM E84—04, Class I rating.
   6. Color stability: No change in 200 hours, tested in accord with NEMA LD3.
   7. Water absorption: Maximum 0.04% for 3/4”, 0.06% for 1/2”, 0.08% for 1/4”, tested in accord with ASTM D570—98.
   10. Impact resistance: No fracture when tested in accord with NEMA LD 3—3.3, 36” for 1/4”, 144” for 1/2”, 204” for 3/4” drop.
   11. Superficial damage to a depth of 0.10” shall be repairable by sanding and polishing.

2.2 CHARACTERISTICS:

A. Finish: Matte (Gloss rating of 5—20).

B. Thicknesses:
   1. Countertops and lavatory tops: 1/2”, 3/4” and 1”, as indicated on drawings.
   2. Window sills: 1/2”.
   3. Wall panels: 1/4”.

C. Colors: Colors as indicated on drawings or as selected by Architect from basis of design manufacturer’s Group E color range.

D. Lavatory tops with bowls:
   1. Provide configurations indicated.
   2. Provide backsplashes, end splashes and aprons as indicated.
   3. Bowls shall be integral with and same material and appearance as adjacent tops.

E. Kitchen and bar sinks: Top mount (drop—in) bowls as specified in Division 15, Mechanical.

2.3 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.

C. Sink/bowl mounting hardware: Manufacturer’s approved bowl clips, brass inserts and fasteners for attachment of undermount sinks/bowls.

2.4 FABRICATION:

A. Factory—fabricate components to greatest extent practicable, to sizes and shapes indicated, in accord with approved shop drawings.

B. Form joints between components using manufacturer’s standard joint adhesive; without conspicuous joints and without voids. Attach a 2” wide reinforcing strip of solid surfacing under each joint.

C. Provide factory cutouts for plumbing fittings and bath accessories as indicated.

D. Rout and finish component edges to a smooth, uniform finish. Rout cutouts and sand edges smooth. Machine radii and contours to template. Repair or reject defective and inaccurate work.

E. Edge treatment for tops: As indicated on drawings.

F. Cold surfaces:
   1. Make cutouts to template furnished by cold appliance manufacturer.
   2. Reinforce joints and cutouts in accord with surfacing manufacturer’s product data.
   3. Provide installation between surfacing and adjacent cold appliances.
   4. Thermally isolate hot and cold appliances.

G. Hot surfaces:
   1. Provide expansion joints in countertops as indicated on shop drawings.
   2. Make cutouts to template furnished by hot appliance manufacturer.
   3. Reinforce joints and cutouts in accord with surfacing manufacturer’s product data.
   4. Provide insulation between surfacing and adjacent hot appliances.
   5. Thermally isolate hot and cold appliances.
   6. Provide venting of cabinets as indicated on drawings.

2.5 SOURCE QUALITY CONTROL:

A. Allowable tolerances:
   1. Variation in component size: ±1/8”.
   2. Location of openings: ±1/8” 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 top mount sinks/bowls to countertops using specified adhesives and color—matched silicone sealants.

D. Install under mount sinks/bowls to countertops per manufacturers written instructions.

E. Provide back and end splashes as indicated. Adhere to countertops using specified color—matched silicone adhesive.

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

G. Make plumbing connections to sinks in accord with Mechanical Division of the Specifications.

3.2 PROTECTION:

A. Protect surfaces from damage until Date of Substantial Completion. Repair or replace damaged work which cannot be repaired.

END OF SECTION
PART 1 GENERAL

1.1 RELATED DOCUMENTS
A. Drawings and general provisions of the Contract, including General and Special Conditions apply to this Section.

1.2 SUMMARY
A. This section includes:
B. Bituminous dampproofing.

1.3 REFERENCES

1.4 SUBMITTALS
A. Product Data: Provide properties of primer, bitumen, and mastics.
B. Manufacturer’s Installation Instructions: Indicate special procedures and perimeter conditions requiring special attention.

1.5 ENVIRONMENTAL REQUIREMENTS
A. Maintain ambient temperatures above 40 degrees F (5 degrees C) for 24 hours before and during application until dampproofing has cured.

PART 2 PRODUCTS

2.0 COLD ASPHALTIC MATERIALS
A. Bitumen: Emulsified asphalt, ASTM D 1227; with fiber reinforcement other than asbestos
B. Asphalt Primer: ASTM D 41, compatible with substrate. (Type II).
C. Sealing Mastic: Asphalt roof cement, ASTM D 2822, Type I.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify existing conditions before starting work.
B. Verify substrate surfaces are durable, free of matter detrimental to adhesion or application of dampproofing system.
C. Verify items which penetrate surfaces to receive dampproofing are securely installed.

3.2 PREPARATION

A. Protect adjacent surfaces not designated to receive dampproofing.
B. Clean and prepare surfaces to receive dampproofing in accordance with manufacturer's instructions.
C. Do not apply dampproofing to surfaces unacceptable to manufacturer.
D. Apply mastic to seal penetrations, small cracks, or minor honeycomb in substrate.

3.3 APPLICATION

A. Prime surfaces, if required, in accordance with manufacturer's instructions.
B. Apply bitumen with mop.
C. Apply bitumen in one coat, continuous and uniform, at a rate per coat recommended by manufacturer.
D. Seal items projecting through dampproofing surface with mastic. Seal watertight.

END OF SECTION
PART 1 - GENERAL

1.1 SUMMARY
   A. Section Includes:
      1. Water repellent coating applied to exterior integrally colored concrete masonry surfaces.
   B. Related Sections:
      1. Section 04200 - Unit Masonry Assemblies: Substrate for application of water repellent.

1.2 SUBMITTALS
   A. Certifications: Submit manufacturer’s certification of conformance to specified surface preparation and application rates.
   B. Test Results: Submit test results of initial and final RILEM test and final spray test.
   C. Contract Closeout Submittals: Submit Letter of Certification under provisions of Section 01770.

1.3 QUALITY ASSURANCE
   A. Qualifications:
      1. Manufacturer: Company specializing in manufacturing Products specified with minimum 5 years documented experience.
      2. Applicator: Company specializing in performing the work of this Section with minimum 5 years documented experience.
   B. Regulatory Requirements: Comply with applicable rules and regulations of Pollution-Control Regulatory Agency having jurisdiction regarding volatile organic compounds (VOC) and use of hydrocarbon solvents.
   C. Field Samples:
      1. Prior to water repellent application, apply water repellent coating to field mock-up sample specified in Section 04200 for determination of coverage rate.
      2. Apply water repellent at an initial rate of application as determined by the manufacturer as presumed necessary to pass the RILEM water tube uptake test results specified.
      3. Allow five days for the sample to cure. Perform a RILEM water tube uptake test on the treated area conducted by or supervised by the manufacturer’s representative. Place one tube on the block surface and one tube on a mortar joint.
      4. Results: Absorption shall be not less than 1.0 milliliter of water using a RILEM water uptake tube at 60 mph wind driven rain equivalent. Apply additional repellent when tests results indicate failing results and retest until passing tests are achieved.
      5. Coverage rate for entire project shall be that which is used to for the mock-up sample passing test.
      6. Provide test report and application rates to the SOR.

1.4 DELIVERY, STORAGE, AND HANDLING
   A. Section 01600 - Materials and Equipment: Transport, handle, store, and protect products.
   B. Protect coating liquid from freezing.

1.5 PROJECT CONDITIONS
A. Environmental Requirements: Do not apply Product during the following conditions:
   1. Ambient temperature below 40 degrees F.
   2. Substrate surfaces have cured less than 30 days.
   3. Rain or temperatures below 40 degrees F are predicted for a period of 24 hours.
   4. Surfaces not dry for minimum 24 hours.
   5. Substrate frozen or surface temperature is below 40 degrees F.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Subject to compliance with project requirements, manufacturer's offering Products which may
   be incorporated in the Work include the following:
   1. BASF Building Systems, Shakopee, MN (800) 433-9517.
   3. Chemprobe Coating Systems, Garland, TX (800) 760-6776.
   5. L&M Construction Chemicals, Incorporated, Omaha, NE (800) 362-3331.

2.2 MATERIALS

A. Description: Clear penetrating water repellent. Siloxanes, silane or siloxane/silane blend, wa-
   terborne and VOC compliant.

B. Products:
   1. Chemprobe: Prime-a-Pell H2O.
   2. BASF (ChemRex): Enviroseal PBT.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine surfaces and adjacent areas where products will be applied and verify that surfaces
   conform to specifications and manufacturer's requirements for substrate conditions. Do not
   proceed until satisfactory conditions have been corrected.

B. Verify joint sealants are installed and cured.

C. Beginning of application indicates acceptance of substrate conditions.

3.2 PREPARATION

A. Surface cracks, holes, or other imperfections that exceed 1/64 of an inch shall be filled with
   pointing mortar. Masonry joints found to be unsound, hollow, or otherwise defective shall be
   raked out to a depth of 1/2 inch and pointed with mortar.
B. Remove loose particles and foreign matter. Remove oil or foreign substance with a cleaning agent which will not affect coating.

C. Scrub and rinse surfaces with water, and let dry.

D. Protect adjacent surfaces not scheduled to receive coating. If applied on unscheduled surfaces, remove immediately, by approved method.

E. Protect landscaping, property, and vehicles from over spray and drift.

3.3 APPLICATION

A. Apply after masonry mortar is cured for not less than seven days.

B. Apply coating in accordance with manufacturer's published instructions, using appropriate method and coverage rate.

3.4 FIELD QUALITY CONTROL

A. Manufacturer's Field Services: Provide services of a manufacturer-authorized technical service representative to inspect and approve the substrate before application, to instruct the applicator on the product and application method to be used, and to field test the in-place surfaces after application.

B. Spray Test: After water repellent has dried, spray coated surfaces with water. After surfaces have adequately dried, recoat surfaces that show water absorption.

C. Water Uptake Test: Perform a RILEM Water Uptake test on a minimum of 10 location on the completed project to confirm conformance to minimum results stated in Part 1 hereinbefore. Conduct test on upper and lower portions of the masonry surfaces and on an equal number of joints and block surfaces. Tests shall be conducted by the manufacturer’s representative.

D. Furnish written certification that surface preparation and rate of application is completed in accordance with specification requirements and the manufacturer's recommendations. Furnish results of in-place RILEM and spray test.

3.5 CLEANING

A. Immediately clean water repellent from adjoining surfaces soiled or damaged by water repellent application as work progresses.

B. Repair damage caused by water repellent application.

C. Comply with manufacturer's published instructions for cleaning.

END OF SECTION
PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Batt Insulation.

B. Related Requirements:
   1. Section 04200 - Unit Masonry Assemblies: Masonry fill insulation.
   2. Section 07840 - Firestopping: Saing insulation used in conjunction with fire stop materi-
      al.
   3. Section 09250 - Gypsum Board: Metal furring.

1.2 REFERENCES

A. The publications listed below form a part of this specification to the extent referenced. Publica-
   tions are referenced within the text by the basic designation only.

B. ASTM International (ASTM):
   2. ASTM C 578 - Rigid, Cellular Polystyrene Thermal Insulation.
   3. ASTM C 665 - Mineral-Fiber Blanket Thermal Insulation for Light Frame Construction and
      Manufactured Housing.
   4. ASTM C 1289 - Faced Rigid Cellular Polyisocyanurate Thermal Insulation Board.
   5. ASTM E 136 - Behavior of Materials in a Vertical Tube furnace at 750 C.

1.3 DEFINITIONS

A. Concealed Insulation: Insulation concealed within framing system, both faces protected by fin-
   ish material.

B. Exposed Insulation: Insulation exposed within framing system, one or both faces unprotected.

1.4 DELIVERY, STORAGE AND HANDLING

A. Transport, handle, store, and protect products in compliance with the requirements of Section
   01600 and manufacturer's recommendations.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Provide products from one of the following manufacturers as specified in the Materials para-
   graph below:
   2. CertainTeed Corporation, Valley Forge, PA (800) 523-7844.
   3. Dow Chemical Company, Midland, MI (800) 232-2436.
   4. Firestone Building Products Company, Carmel, IN (800) 428-4442.
   5. Guardian Fiberglass Incorporated, Albion, MI (800) 748-0035.
   7. Owens-Corning, Toledo, OH (800) 438-7465.
   8. Pactiv Building Products, Atlanta, GA (800) 241-4402.
2.2 REGULATORY REQUIREMENTS

A. Fire-Test-Response Characteristics: Provide insulation and related materials with the fire-test-response characteristics indicated, as determined by testing identical products per ASTM E 84 for surface-burning characteristics and other methods specified. Identify materials with appropriate markings of applicable testing and inspecting agency.

2.3 MATERIALS

A. Batt Insulation: ASTM C 665 mineral fiber blanket insulation.
   1. Unfaced Glass Fiber: Type I (blankets without membrane facing); with maximum flame-spread and smoke-developed indexes of 25 and 50, respectively passing ASTM E 136 for combustion characteristics.
   2. Faced, Glass-Fiber: Type III (blankets with reflective membrane facing), Class A (membrane-faced surface with a flame-spread index of 25 or less); Category 1 (membrane is a vapor barrier), faced with vapor-retarder membrane on 1 face.
   3. Sound Attenuation Insulation (Sound Batts): Unfaced glass fiber batt insulation as specified above.
   4. Provide batt insulation by one of the following manufacturers:
      a) CertainTeed Corporation.
      b) Guardian Fiberglass, Inc.
      c) Johns Manville.
      d) Owens Corning.

B. Substitutions: Comply with the requirements of Section 01600.

2.4 ACCESSORIES

A. Tape: Polyethylene or polyester self-adhering type; two inches wide.

B. Adhesive: Waterproof type, acceptable to manufacturer of insulation board. Adhesive VOC shall be within the limits of not greater than 70 g/L in accordance with the California’s South Coast Air Quality Management District (SCAQMD) Rule No. 1168.

PART 3 - EXECUTION

3.1 PREPARATION

A. Batt Insulation:
   1. Verify adjacent materials are dry and ready to receive installation.
   2. Verify mechanical and electrical services within walls have been installed and tested.

3.2 INSTALLATION - BATT INSULATION

A. Install batt insulation in accordance with manufacturer's instructions, without gaps or voids.

B. Trim insulation neatly to fit spaces. Use batts free of damage. Fit insulation tight in spaces and tight to exterior side of mechanical and electrical services within the plane of insulation.

C. Install insulation with factory applied membrane facing warm side in winter of building spaces. Lap ends and side flanges of membrane. Attach insulation in place to framing; tape seal butt ends and lapped side flanges. Tape seal tears or cuts in membrane.
3.3 INSTALLATION - INSULATION AT FURRED-OUT MASONRY WALLS

A. Apply insulation to interior of exterior CMU wall between furring strips where furring is indicated on Drawings.

3.4 SCHEDULES

A. Provide insulation types as scheduled below and as indicated on Drawings.

<table>
<thead>
<tr>
<th>CONDITION</th>
<th>TYPE OF INSULATION</th>
<th>THICKNESS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Exterior Wall, Soffits, &amp; Ceiling</td>
<td>Faced Batt Insulation</td>
<td>3-1/2 inches (R=11) or 6 inches (R=19) or 8 inches (R-25) as shown; or as required to fill cavity.</td>
</tr>
<tr>
<td>Interior Partitions</td>
<td>Unfaced Batt Insulation</td>
<td>3-1/2 inches or 6 inches as shown.</td>
</tr>
<tr>
<td>Sound Attenuation</td>
<td>Unfaced Batt Insulation</td>
<td>3-1/2 inches or 6 inches as shown.</td>
</tr>
</tbody>
</table>

END OF SECTION
PART 1 GENERAL

1.1 SUMMARY

A. Section Includes: Field applied polymer based non-drainable exterior insulation and finish system (EIFS) applied over masonry units.

B. Related Requirements:
   1. Section 07243 - Exterior Insulation And Finish System (EIFS) (Sheathing Substrate).
   2. Section 07901 - Joint Sealants: Joint sealants used in conjunction with exterior insulation and finish system.
   3. Section 09900 - Painting: Field applied paint finish.

1.2 REFERENCES

A. The publications listed below form a part of this specification to the extent referenced. Publications are referenced within the text by the basic designation only.

B. ASTM International (ASTM):
   1. ASTM C 578 - Rigid, Cellular Polystyrene Thermal Insulation.
   2. ASTM E 84 - Surface Burning Characteristics of Building Materials.
   5. ASTM E 2430 - Expanded Polystyrene ("EPS") Thermal Insulation Boards For Use In Exterior Insulation and Finish Systems ("EIFS").

C. ICC Evaluation Service, Inc. (ICC-ES):

D. National Fire Protection Association (NFPA):

1.3 PREINSTALLATION MEETING

A. Convene Preinstallation Meeting at Site one week prior to commencing work of this Section.

B. Attendance:
   1. Require attendance of parties directly affecting work of this Section, including, but not limited to the following:
      a. General Contractor.
      b. EIFS Subcontractor.
      c. Testing Laboratory.
      d. EIFS Manufacturer's Representative.
   2. Notify attendees at least two weeks prior to the conference.

C. Agenda:
   1. Review preparation and installation procedures and coordinating and scheduling required with related work.
   2. Review foreseeable methods and procedures related to roofing work, including the following:
3. Tour, inspect and discuss condition of substrate, penetrations and other preparatory work performed by other trades.
4. Review EIFS system requirements (Drawings, Specifications and other Contract Documents including submittals).
5. Review required submittals.
6. Review and finalize construction schedule related to EIFS work and verify availability of materials, installer's personnel, equipment, and facilities needed to make progress and avoid delays.
7. Review required inspections, testing, and material usage accounting procedures.
8. Review weather and forecasted weather conditions, and procedures for coping with unfavorable conditions.

1.4 DOCUMENTATION

A. Record discussions of conference and decisions and agreements reached and furnish copy of record to each party attending.

1.5 SUBMITTALS

A. Comply with the requirements of Section 01330.
B. Product Data: Submit data showing all system components and diagrams of complete system to be used.
C. Manufacturer's Observation Report: Submit observations report by manufacturer as specified in Part 3 of this Section.
D. Evaluation Reports: Submit current ICC-ER report specified in Part 2 of this Section.

1.6 CLOSEOUT SUBMITTALS

A. Comply with the requirements of Section 01770.
B. Contractor Installation Declaration Forms: Include completed Exhibit A and Exhibit B forms (included at the end of this section) signed by EIFS Contractor and Sealant Installer.
C. Manufacturer's Observation Reports: Submit report signed by EIFS manufacturer of observations during site visit by manufacturer's representative.

1.7 QUALITY ASSURANCE

A. Installer Qualifications: Single firm, approved in writing by EIFS manufacturer, employing trained workers familiar with current installation methods and materials. Installer shall have not less than 2 years documented experience in the installation of the specific system to be installed.
B. Source Limitations: Obtain EIFS from single source from single EIFS manufacturer and from sources approved by EIFS manufacturer as compatible with system components.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide EIFS by one of the following:

1. **BASF Wall Systems, Inc.**, Jacksonville, FL (Formerly Senergy, Inc & Degussa Wall Systems) (800) 221-9255. Contact: Steve DonFrancesco (770) 335-5260.
3. Omega Products International, Inc., Los Angeles, CA, (800) 600-6634
4. Sto Corp., Atlanta, GA. Contact Strategic Accounts (888) 786-3437.
5. ParexUSA, Anahiem, CA., (866) 516-0061, Contact: Susan Foster, National Accounts Manager (714) 319-3186.

2.2 PRODUCTS

A. Products: Standard Class PB EIFS System. Provide one of the following products:
1. Senerflex Classic PB Wall System by Senergy (BASF).
2. Outsulation by Dryvit.
3. Akroflex Barrier EIFS, Class PB by Omega.
4. StoTherm Essence by Sto.
5. Standard EIFS System by Parex.

B. Substitutions: Comply with the requirements of Section 01631.

2.3 PERFORMANCE REQUIREMENTS

A. EIFS Performance: Comply with ASTM E 2568 and with the following:

B. Weathertightness: Resistant to water penetration from exterior.

C. Bond Integrity: System shall be free from bond failure within EIFS components or between system and supporting wall construction, resulting from exposure to wind loads, weather, or other in-service conditions.

D. Fire-Test-Response Characteristics: Provide EIFS and system components with the following fire-test-response characteristics as determined by testing identical EIFS and system components per test method indicated below by UL or another testing and inspecting agency acceptable to Authorities Having Jurisdiction. Identify products with appropriate markings of applicable testing agency.
1. Radiant Heat Exposure: No ignition of EIFS per NFPA 268.
3. Surface-Burning Characteristics: Insulation board, adhesives, base coats, and finish coats with flame-spread index of 25 or less and smoke-developed index of 450 or less, per ASTM E 84.

E. Evaluation Report: The system proposed for use from the specified products shall have a current Evaluation Report (ICC-ER) by the International Code Council Evaluation Service (ICC-ES) in accordance with ICC AC 219 Acceptance Criteria showing compliance with the International Building Code or the model code within the jurisdiction of the project and as required by the Authority Having Jurisdiction.

2.4 MATERIALS

A. General: Provide materials and EIFS components standard with the manufacturer as applicable for the product systems listed and selected for the project.

B. Compatibility: Provide adhesive, fasteners, board insulation, reinforcing meshes, base- and finish-coat systems, sealants, and accessories that are compatible with one another and compliant with EIFS manufacturer’s printed instructions.

C. Flashing: EIFS manufacturer’s standard or product recommended by EIFS manufacturer.
D. Insulation Adhesive: EIFS manufacturer’s standard formulation. Adhesive VOC shall be not greater than 50 g/L as set forth in the California’s South Coast Air Quality Management District (SCAQMD) Rule No. 1168.

E. Board Insulation: Molded, rigid cellular polystyrene, complying with ASTM C 578, Type I; expanded polystryene (EPS) complying with ASTM E 2430; or polyisosyanurate; as required by and in accordance with EIFS manufacturer's requirements.

F. Reinforcing Mesh: Balanced, alkali-resistant, open-weave, glass-fiber mesh; complying with ASTM D 578 and the following:
   1. Standard-Impact Reinforcing Mesh: Not less than 4.0 oz./sq. yd.
   2. Heavy-Duty Reinforcing Mesh: Not less than 20 oz./sq. yd.
   3. Strip Reinforcing Mesh: Not less than 3.75 oz./sq. yd.
   4. Detail Reinforcing Mesh: Not less than 4.0 oz./sq. yd.
   5. Corner Reinforcing Mesh: Not less than 7.2 oz./sq. yd.

G. Base-Coat Materials: Manufacturer’s standard formulation.

H. Primer (If Required by Manufacturer): EIFS manufacturer's standard factory-mixed primer for preparing base-coat surface for application of finish coat.

   1. Integral Color: To be selected by Architect from a full range of manufacturers standard colors.
   2. Paint Finish: Field applied paint finish as specified in Section 09900. Color to be selected by Architect from a full range of manufacturers standard colors.
      a. Texture: Equivalent to Dryvit standard “Sandblast”.

J. Mechanical Fasteners (If required by manufacturer): Corrosion-resistant fasteners consisting of thermal cap, standard washer and shaft attachments, and fastener suitable for substrate.

K. Trim Accessories: Manufactured from UV-stabilized PVC and complying with ASTM D 1784.

L. Joint Sealant: Joint sealant shall be as specified in Section 07901 unless otherwise required by the EIFS manufacturer.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of EIFS.

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

C. Begin coating application only after surfaces are dry.

3.2 PREPARATION

A. Protect contiguous work from moisture deterioration and soiling caused by application of EIFS. Provide temporary covering and other protection needed to prevent spattering of exterior finish coats on other work.

B. Protect EIFS, substrates, and wall construction behind them from inclement weather during installation.
C. Prepare and clean substrates to comply with EIFS manufacturer’s written instructions to obtain optimum bond between substrate and adhesive for insulation.

3.3 INSTALLATION

A. Comply with ASTM C 1397 and EIFS manufacturer’s written instructions for installation of EIFS as applicable to type of substrate indicated.

B. If drainable EIFS on sheathing substrate (Section 07243) is installed above EIFS on masonry substrate (Section 07241), then continue installation of drainable EIFS on masonry substrate.

C. Flexible-Membrane Flashing: Install to shed water; seal at openings, penetrations, terminations, and where indicated by EIFS manufacturer’s written instructions to protect wall assembly from degradation. Prime substrates, if required, and install flashing to comply with EIFS manufacturer’s written instructions and details.

D. Trim: Apply trim accessories at locations indicated on Drawings.

E. Board Insulation: Adhesively attach to substrate.

F. Expansion Joints: Install at locations indicated, where required by EIFS manufacturer, where expansion joints or control joints are indicated in substrates behind EIFS; where EIFS adjoin dissimilar substrates, materials, and construction; and where wall height changes

1. Do not exceed manufacturer’s maximum recommended area.
2. Coordinate placement of additional joints with Architect.

G. Base Coat: Apply to exposed surfaces of insulation and foam shapes in minimum thickness recommended in writing by EIFS manufacturer, but not less than 1/16-inch dry-coat thickness.

H. Reinforcing Mesh:

1. Place reinforcing mesh over insulation and secure in place with base coating.
2. Completely embed mesh in wet base coat, applying additional base-coat material if necessary, so reinforcing-mesh color and pattern are not visible.
3. Apply heavy weight mesh in conjunction with standard weight mesh in areas below 8 feet above ground level.

I. Finish Coat: Apply over dry base coat, maintaining a wet edge at all times for uniform appearance, in thickness required by EIFS manufacturer to produce a uniform finish of color and texture matching approved sample and free of cold joints, shadow lines, and texture variations.

J. Form 3/4 inch drip rustication joints straight and true to line, as indicated on Drawings.

3.4 JOINTS

A. Install sealant at joints within system and where system abuts dissimilar materials. Apply joint sealant using sealant type, application method, and installation procedures in accordance with manufacturer’s recommendation and Section 07901 and the EIFS manufacturers evaluation report.

3.5 REPAIR OF DAMAGED OR NON-CONFORMING WORK

A. Repair or correct installed work which is damaged during construction or is otherwise incomplete or not conforming to specification requirements. Repair and correction shall be in accordance with manufacturer’s written and published instructions.
3.6 FIELD QUALITY CONTROL

A. Manufacturer Services: A representative of the manufacturer shall visit the site prior to installation of EIFS, during installation, and upon completion of installation of EIFS to become familiar with material and methods being applied. Site visits shall be coordinated 2 weeks in advance and include observation of substrate, installation, and installation procedure to the extent observed. Manufacturer’s representative shall prepare observation report stating conformance or deficiencies noted.

END OF SECTION
EIFS Contractor Installation Declaration Form

EIFS Contractor Name: ____________________________________________

Completion Date: ________________________________________________

THE EXTERIOR INSULATION AND FINISH SYSTEM (EIFS) INSTALLED ON THE STRUCTURE LOCATED AT THE ADDRESS INDICATED BELOW CONFORMS:

TO ___________________________ RECOMMENDED INSTALLATION PRACTICES AND (Insert EIFS Manufacturer Name Here)

FOR ___________________________ AND SECTION(S) __________________________ OF ICC (Insert Appropriate Section Numbers Here)

EVALUATION REPORT NO. ____________________________ (Insert Applicable Report Number Here)

Address of Structure: Product Component Names:

________________________________________________________________________ Adhesive(s):
________________________________________________________________________
________________________________________________________________________ Fasteners (Mech.):
________________________________________________________________________ Base Coat:
________________________________________________________________________ Reinforcing Fabric:
________________________________________________________________________ Finish Coat (s):

INSTALLATION CONFORMS
A. Substrate Type and Tolerance
B. EIFS
   1. Adhesive and/or Fasteners
   2. Insulation
   3. Reinforcing Fabric
   4. Base Coat
   5. Finish
C. The information entered above is offered in testimony that the EIFS installation conforms with the EIFS manufacturer's installation methods and procedures, and the EIFS manufacturers ES report.
D. An installation card shall be received from the Sealant Installer indicating that the sealant installation conforms with the EIFS evaluation report and sealant manufacturer's installation methods and procedures must accompany this declaration.

EIFS Contractor Company Name and Address:
________________________________________________________________________
________________________________________________________________________

Signature of Responsible Officer: ____________________________________________

Typed Name and Title of Officer: ____________________________________________

Telephone Number: ____________________________________________

cc: Original: Building Department (Must be submitted with sealant installer declaration.)
    Copies: EIFS Manufacturer

07241-7
EXHIBIT B
EIFS Sealant Contractor Installation Declaration Form

Sealant Installer Name: ____________________________________________

Completion Date: ________________________________________________

THE SEALANT INSTALLED IN CONJUNCTION WITH AN EXTERIOR INSULATION AND FINISH SYSTEM (EIFS) INSTALLED ON THE STRUCTURE LOCATED AT THE ADDRESS INDICATED BELOW CONFORMS:

TO ___________________________ and ___________________________ RECOMMENDED
(Insert EIFS Manufacturer Name Here) (Insert Sealant Manufacturer Name Here)

INSTALLATION PRACTICES AND SECTION(S) ___________________________ OF ICC
(Insert Appropriate Section Numbers Here)

EVALUATION REPORT NO. ___________________________.
(Insert Applicable Report Number Here)

Address of Structure: ____________________________________________

Product Component Names:

Primer(s): ______________________________________________________

Sealers: ________________________________________________________

Bond Breakers: _________________________________________________

Sealant Materials: ______________________________________________

INSTALLATION CONFORMS

A. Designer's requirements, details and instructions
B. Sealant Manufacturer's details and Requirements
C. Exterior Insulation Manufacturer's Requirements
D. The information entered above is offered in testimony that the Sealant installation conforms with the Sealant manufacturer's installation methods and procedures, and the EIFS manufacturers evaluation report.

Sealant Installer Company Name and Address:

________________________________________________________________________
________________________________________________________________________
________________________________________________________________________

Signature of Responsible Officer: __________________________________________

Typed Name and Title of Officer: __________________________________________

Telephone Number: (_____) __________________________

cc: Original: Building Department (Must be submitted with EIFS contractor declaration.)
    Copies: EIFS Manufacturer
             EIFS Contractor
             Sealant Manufacturer
             Owner (include in Final Closeout Submittals)

END OF FORM
PART 1  GENERAL

1.1  SUMMARY

A. Section Includes: Field applied channeled or grooved insulation water-drainage exterior insulation and finish system (EIFS) applied over sheathing substrate.

B. Related Requirements:
1. Section 05400 - Cold Formed Metal Framing: Framing for gypsum sheathing substrate.
2. Section 06100 - Rough Carpentry: Non-structural plywood panels used for sheathing.
4. Section 07901 - Joint Sealants: Joint sealants used in conjunction with exterior insulation and finish system.
5. Section 09250 - Gypsum Board: Gypsum sheathing.
6. Section 09900 - Painting: Field applied paint finish.

1.2  REFERENCES

A. The publications listed below form a part of this specification to the extent referenced. Publications are referenced within the text by the basic designation only.

B. ASTM International (ASTM):
1. ASTM C 578 - Rigid, Cellular Polystyrene Thermal Insulation.
5. ASTM E 2430 - Expanded Polystyrene ("EPS") Thermal Insulation Boards For Use In Exterior Insulation and Finish Systems ("EIFS").

C. ICC Evaluation Service, Inc. (ICC-ES):
1. ICC-ES AC212 - Acceptance Criteria For Water-Resistive Coatings Used As Water-Resistive Barriers Over Exterior Sheathing.

D. National Fire Protection Association (NFPA):

1.3  PREINSTALLATION MEETING

A. Convene Preinstallation Meeting at Site one week prior to commencing work of this Section.

B. Attendance:
1. Require attendance of parties directly affecting work of this Section, including, but not limited to the following:
   a. General Contractor.
   b. EIFS Subcontractor.
   c. Testing Laboratory.
   d. EIFS Manufacturer's Representative.
2. Notify attendees at least two weeks prior to the conference.
C. Agenda:
1. Review preparation and installation procedures and coordinating and scheduling required with related work.
2. Review foreseeable methods and procedures related to roofing work, including the following:
3. Tour, inspect and discuss condition of substrate, penetrations and other preparatory work performed by other trades.
4. Review EIFS system requirements (Drawings, Specifications and other Contract Documents including submittals).
5. Review required submittals.
6. Review and finalize construction schedule related to EIFS work and verify availability of materials, installer's personnel, equipment, and facilities needed to make progress and avoid delays.
7. Review required inspections, testing, and material usage accounting procedures.
8. Review weather and forecasted weather conditions, and procedures for coping with unfavorable conditions.

1.4 DOCUMENTATION
A. Record discussions of conference and decisions and agreements reached and furnish copy of record to each party attending.

1.5 SUBMITTALS
A. Comply with the requirements of Section 01330.
B. Product Data: Submit data showing all system components and diagrams of complete system to be used.
C. Evaluation Reports: Submit current ICC-ER report specified in Part 2 of this Section.

1.6 CLOSEOUT SUBMITTALS
A. Comply with the requirements of Section 01770.
B. Contractor Installation Declaration Forms: Include completed Exhibit A and Exhibit B forms (included at the end of this section) signed by EIFS Contractor and Sealant Installer.
C. Manufacturer's Observation Reports: Submit report signed by EIFS manufacturer of observations during site visit by manufacturer’s representative.

1.7 QUALITY ASSURANCE
A. Installer Qualifications: Single firm, approved in writing by EIFS manufacturer, employing trained workers familiar with current installation methods and materials. Installer shall have not less than 2 years documented experience in the installation of the specific drainable system to be installed and on projects of same size and scope.
B. Source Limitations: Obtain EIFS from single source from single EIFS manufacturer and from sources approved by EIFS manufacturer as compatible with system components.

PART 2 PRODUCTS

2.1 MANUFACTURERS
A. Manufacturers: Subject to compliance with requirements, provide EIFS by one of the following:
2.2 PRODUCTS

A. Products: Drainable, with channeled, grooved, or corrugated insulation board, Class PB EIFS System. Provide one of the following products:
1. Senerflex Channeled Insulation Design by Senergy (BASF).
2. Outsulation Plus MD with grooved insulation board option by Dryvit.
3. Akroflex WM Water Managed Drainage Board System, Class PB by Omega.
4. Sto Essense NexT System, with grooved insulation board option by Sto.
5. Standard Watermaster-GX by Parex.

B. Substitutions: Comply with the requirements of Section 01631.

2.3 PERFORMANCE REQUIREMENTS

A. Bond Integrity: System shall be free from bond failure within EIFS components or between system and supporting wall construction, resulting from exposure to wind loads, weather, or other in-service conditions.

B. Weathertightness: System shall be resistant to water penetration from exterior into water-drainage EIFS and assemblies behind it or through them into interior of building that results in deterioration of thermal-insulating effectiveness or other degradation of EIFS and assemblies behind it, including substrates, supporting wall construction, and interior finish, and including a means that allows water entering into an EIFS assembly to drain to the exterior.


D. Fire-Test-Response Characteristics: Provide EIFS and system components with the following fire-test-response characteristics as determined by testing identical EIFS and system components per test method indicated below by UL or another testing and inspecting agency acceptable to Authorities Having Jurisdiction. Identify products with appropriate markings of applicable testing agency.
1. Radiant Heat Exposure: No ignition of EIFS per NFPA 268.
3. Surface-Burning Characteristics: Insulation board, adhesives, base coats, and finish coats with flame-spread index of 25 or less and smoke-developed index of 450 or less, per ASTM E 84.

E. Evaluation Report: The system proposed for use from the specified products shall have a current Evaluation Report (ICC-ER) by the International Code Council Evaluation Service (ICC-ES) showing compliance with the ICC Acceptance Criteria specified herein and the International Building Code or the model code within the jurisdiction of the project and as required by the Authority Having Jurisdiction.

2.4 MATERIALS

A. General: Provide materials and EIFS components standard with the manufacturer as applicable.
for the product systems listed and selected for the project.

B. Compatibility: Provide water-resistive coating, adhesive, fasteners (as applicable), board insulation, reinforcing meshes, base- and finish-coat systems, sealants, and accessories that are compatible with one another and compliant with EIFS manufacturer’s printed instructions.

C. Water-Resistive Coatings: EIFS manufacturer's standard formulation and accessories for use as water/weather-resistive barriers, compatible with substrate, and complying with physical and performance criteria of ICC-ES AC212.

D. Flashing: EIFS manufacturer's standard or product recommended by EIFS manufacturer.

E. Insulation Adhesive: EIFS manufacturer's standard formulation. Adhesive VOC shall be not greater than 50 g/L as set forth in the California’s South Coast Air Quality Management District (SCAQMD) Rule No. 1168.

F. Board Insulation: Molded, rigid cellular polystyrene, complying with ASTM C 578, Type I; expanded polystyrene (EPS) complying with ASTM E 2430; or polyisosyanurate; as required by and in accordance with EIFS manufacturer's requirements.

1. Channeled Board Insulation: EIFS manufacturer's standard factory-fabricated profile with linear, vertical drainage channels, corrugations, slots, or waves on the back side of board. Minimum thickness: 1 1/2 inch.

2. Provide means of drainage as required with drainage assemblies at base of EIFS.

G. Reinforcing Mesh: Balanced, alkali-resistant, open-weave, glass-fiber mesh; complying with ASTM D 578 and the following:

1. Standard-Impact Reinforcing Mesh: Not less than 4.0 oz./sq. yd.

2. Heavy-Duty Reinforcing Mesh: Not less than 20 oz./sq. yd.

3. Strip Reinforcing Mesh: Not less than 3.75 oz./sq. yd.

4. Detail Reinforcing Mesh: Not less than 4.0 oz./sq. yd.

5. Corner Reinforcing Mesh: Not less than 7.2 oz./sq. yd.

H. Base-Coat Materials: Manufacturer's standard formulation.

I. Primer: Factory-mixed primer if and as recommended by manufacturer.


1. Integral Color: To be selected by Architect from a full range of manufacturers standard colors.

2. Paint Finish: Field applied paint finish as specified in Section 09900. Color to be selected by Architect from a full range of manufacturers standard colors.

a. Texture: Equivalent to Dryvit standard "Sandblast".

K. Mechanical Fasteners (If required by manufacturer): Corrosion-resistant fasteners consisting of thermal cap, standard washer and shaft attachments, and fastener suitable for substrate.

L. Trim Accessories: Manufactured from UV-stabilized PVC and complying with ASTM D 1784 and ASTM C 1063.

M. Joint Sealant: Joint sealant shall be as specified in Section 07901 unless otherwise required by the EIFS manufacturer.

PART 3 - EXECUTION

3.1 EXAMINATION
A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of EIFS.

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

C. Begin coating application only after surfaces are dry.

3.2 PREPARATION

A. Protect contiguous work from moisture deterioration and soiling caused by application of EIFS. Provide temporary covering and other protection needed to prevent spattering of exterior finish coats on other work.

B. Protect EIFS, substrates, and wall construction behind them from inclement weather during installation. Prevent penetration of moisture behind drainage plane of EIFS and deterioration of substrates.

C. Prepare and clean substrates to comply with EIFS manufacturer's written instructions to obtain optimum bond between substrate and adhesive for insulation.

3.3 INSTALLATION

A. Comply with EIFS manufacturer's written instructions for installation of EIFS as applicable to type of substrate indicated.

B. If drainable EIFS on sheathing substrate (Section 07243) is installed above EIFS on masonry substrate (Section 07241), then continue installation of drainable EIFS on masonry substrate.

C. Water-Resistive Coatings: Apply over substrates to protect substrates from degradation and to provide water/weather-resistant barrier.

D. Flexible-Membrane Flashing: Install over weather-resistant barrier, applied and lapped to shed water; seal at openings, penetrations, terminations, and where indicated by EIFS manufacturer's written instructions to protect wall assembly from degradation. Prime substrates, if required, and install flashing to comply with EIFS manufacturer's written instructions and details.

E. Trim: Apply trim accessories at locations indicated on Drawings.

F. Board Insulation: Attach to substrate.

G. Expansion Joints: Install at locations indicated, where required by EIFS manufacturer, where expansion joints or control joints are indicated in substrates behind EIFS; where EIFS adjoin dissimilar substrates, materials, and construction; and where wall height changes
   1. Do not exceed manufacturer's maximum recommended area.
   2. Coordinate placement of additional joints with Architect.

H. Base Coat: Apply to exposed surfaces of insulation and foam shapes in minimum thickness recommended in writing by EIFS manufacturer, but not less than 1/16-inch dry-coat thickness.

I. Reinforcing Mesh:
   1. Place reinforcing mesh over insulation and secure in place with base coating.
   2. Completely embed mesh in wet base coat, applying additional base-coat material if necessary, so reinforcing-mesh color and pattern are not visible.
   3. Apply heavy weight mesh in conjunction with standard weight mesh in areas below 8 feet above ground level.
J. Finish Coat: Apply over dry base coat, maintaining a wet edge at all times for uniform appearance, in thickness required by EIFS manufacturer to produce a uniform finish of color and texture matching approved sample and free of cold joints, shadow lines, and texture variations.

K. Form 3/4 inch rustication joints straight and true to line, as indicated on Drawings.

3.4 JOINTS

A. Install sealant at joints within system and where system abuts dissimilar materials. Apply joint sealant using sealant type, application method, and installation procedures in accordance with manufacturer’s recommendation and Section 07901 and the EIFS manufacturers evaluation report. Do not seal drainage weep holes or outlets.

3.5 REPAIR OF DAMAGED OR NON-CONFORMING WORK

A. Repair or correct installed work which is damaged during construction or is otherwise incomplete or not conforming to specification reqirements. Repair and correction shall be in accordance with manufacturer’s written and published instructions.

3.6 FIELD QUALITY CONTROL

A. Field quality control shall be the complete responsibility of the Contractor in accordance with Section 01400. Field quality control testing and inspection shall be at the descretion of the Contractor as necessary to assure compliance with Contract requirements. T&I specified below shall not preclude Contractor responsibility to perform similar routine, necessary, and customary testing and inspection of the methods and frequency suitable for the type of work involved.

B. Manufacturer Services: A representative of the manufacturer shall visit the site prior to installation of EIFS, during installation, and upon completion of installation of EIFS to become familiar with material and methods being applied. Site visits shall be coordinated 2 weeks in advance and include observation of substrate, installation, and verification of proper procedure to the extent observed. Manufacturer’s Representative shall prepare observation report stating conformance or deficiencies noted.

3.7 TESTING AND INSPECTION (T&I)

A. The testing firm will perform testing and inspection (T & I) but only as a means to satisfy the Owner of contract compliance and as assurance to the Owner of Contractor quality control performance.

B. T&I specified herein below will be performed by the Testing Laboratory (TL) in accordance with Section 01400

C. Special Inspections: TL shall perform special inspections of water-resistive barrier for EIFS and prepare reports according to ICC-ES AC 212 and AC235.

1. Perform one time inspection of water-resistive barrier installation to verify compliance with the Acceptance Criteria (AC) as specified above.

END OF SECTION

07243-6

College Park Fire Station #3 - B1003-00
EXHIBIT A
EIFS Contractor Installation Declaration Form

EIFS Contractor Name: ________________________________

Completion Date: ________________________________

THE EXTERIOR INSULATION AND FINISH SYSTEM (EIFS) INSTALLED ON THE STRUCTURE LOCATED AT THE ADDRESS INDICATED BELOW CONFORMS:

TO ________________________________ RECOMMENDED INSTALLATION PRACTICES AND
(Insert EIFS Manufacturer Name Here)

FOR ________________________________ AND SECTION(S) ________________ OF ICC
(Insert EIFS System name here) (Insert Appropriate Section Numbers Here)

EVALUATION REPORT NO. ________________________________
(Insert Applicable Report Number Here)

Address of Structure: ________________________________

Product Component Names:

Adhesive(s): ________________________________

Fasteners (Mech.): ________________________________

Base Coat: ________________________________

Reinforcing Fabric: ________________________________

Finish Coat (s): ________________________________

INSTALLATION CONFORMS

A. Substrate Type and Tolerance

B. EIFS

1. Adhesive and/or Fasteners

2. Insulation

3. Reinforcing Fabric

4. Base Coat

5. Finish

C. The information entered above is offered in testimony that the EIFS installation conforms with the EIFS manufacturer's installation methods and procedures, and the EIFS manufacturers ES report.

D. An installation card shall be received from the Sealant Installer indicating that the sealant installation conforms with the EIFS evaluation report and sealant manufacturer's installation methods and procedures must accompany this declaration.

EIFS Contractor Company Name and Address:

______________________________________________

______________________________________________

______________________________________________

Signature of Responsible Officer:

______________________________________________

Typed Name and Title of Officer:

______________________________________________

Telephone Number: ________________________________

cc: Original: Building Department (Must be submitted with sealant installer declaration.)

Copies: EIFS Manufacturer

07243-7

College Park Fire Station #3 - B1003-00
Owner (include in Final Closeout Submittals)

END OF FORM
EXHIBIT B
EIFS Sealant Contractor Installation Declaration Form

Sealant Installer Name: ________________________________

Completion Date: ________________________________

THE SEALANT INSTALLED IN CONJUNCTION WITH AN EXTERIOR INSULATION AND FINISH SYSTEM (EIFS) INSTALLED ON THE STRUCTURE LOCATED AT THE ADDRESS INDICATED BELOW CONFORMS:

TO ________________________________ and ________________________________ RECOMMENDED
(Insert EIFS Manufacturer Name Here) (Insert Sealant Manufacturer Name Here)

INSTALLATION PRACTICES AND SECTION(S) ________________________________ OF ICC
(Insert Appropriate Section Numbers Here)

EVALUATION REPORT NO. ________________________________
(Insert Applicable Report Number Here)

Address of Structure: ____________________________________

Product Component Names:

Primer(s): ________________________________
Sealers: ________________________________
Bond Breakers: ________________________________
Sealant Materials: ________________________________

INSTALLATION CONFORMS

A. Designer’s requirements, details and instructions

B. Sealant Manufacturer’s details and Requirements

C. Exterior Insulation Manufacturer’s Requirements

D. The information entered above is offered in testimony that the Sealant installation conforms with the Sealant manufacturer's installation methods and procedures, and the EIFS manufacturers evaluation report.

Sealant Installer Company Name and Address:

____________________________________

____________________________________

____________________________________

Signature of Responsible Officer: ________________________________

Typed Name and Title of Officer: ________________________________

Telephone Number: (_____) ________________________________

cc: Original: Building Department (Must be submitted with EIFS contractor declaration.)
Copies: EIFS Manufacturer
EIFS Contractor
Sealant Manufacturer
Owner (include in Final Closeout Submittals)

END OF FORM
PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Standing seam metal roofing (SSMR) and accessories.

B. Related Sections:

1.2 REFERENCES

A. The publications listed below form a part of this specification to the extent referenced. Publications are referenced within the text by the basic designation only.

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

C. ASTM International (ASTM):
   1. ASTM A 755A - Steel Sheet, Metallic Coated by the Hot-Dip Process and Prepainted by the Coil-Coating Process for Exterior Exposed Building Products.
   2. ASTM A 792A - Steel Sheet, 55% Aluminum-Zinc Alloy-Coated by the Hot-Dip Process.

1.3 QUALITY ASSURANCE

A. Installer Qualifications: Company specializing in performing Work of this Section with minimum 5 years documented experience certified by sheet metal roofing manufacturer as an "Approved Installer."

1.4 DELIVERY, STORAGE AND HANDLING

A. Section 01600 - Product Requirements: Deliver, handle, store, and protect products.

B. Stack preformed and prefinished material to prevent twisting, bending, or abrasion, and to provide ventilation. Comply with manufacturer's recommendations for job site storage, handling, and protection.

C. Prevent contact with materials during storage which may cause discoloration or staining.

D. Do not overload roof structure with stored materials. Do not permit material storage or traffic on completed roof surfaces.

1.5 WARRANTY

A. Provide manufacturer's twenty year standard warranty against failure due to corrosion, rupture or perforation.
B. Provide manufacturer’s standard warranty covering watertightness of the roofing system for the period of two years from the date of substantial completion.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Standing Seam Metal Roof Panel: 24 gage; Aluminum-Zinc Alloy-Coated Steel Sheet, ASTM A 792A, Class AZ50 coating designation, Grade 40, structural quality, UL90 rated panels, and prepainted by the coil-coating process to comply with ASTM A 755/A. Provide panels by one of the following:
   1. Snap-Seam System Standing Seam Roof by AEP-SPAN, Dallas, TX (800) 527-2503.
   2. Cee-Lock Snap-Lock Standing Seam Roof by Berridge Manufacturing Company, Houston, TX (800) 231-8127.
   3. UC-14 Standing Seam Roof System by UNA-CLAD, Firestone Metal Products, Anoka, MN (800) 426-7737.
   4. Lokseam Standing Seam Roof System by MBCI, (800) 206-6224.
   5. Snap-Clad Standing Seam Roof System by PAC-CLAD, Petersen Aluminum Corporation, Elk Grove Village, IL (800) 722-2523.

B. Seam Spacing:
   1. AEP-SPAN: 18 inches. (10", 12", and 24" available)
   2. Berridge: 16-1/2 inches.
   3. Firestone: 18 inches (10, 12, and 16" available)
   4. MBCI: 18 inches (10" and 12" available)
   5. PAC-CLAD: 18 inches (10", 12", and 16" available)

C. Finish: Smooth panel with factory finished baked-on fluropolymer 2-coat coating system.
   1. Manufacturer's standard 2-Coat Fluoropolymer conforming to AAMA 621. Fluoropolymer finish containing not less than 70 percent Kynar 500 PVDF resin by weight in color coat with a minimum of 0.9 mil dry film thickness. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.
   2. Color: To be selected by Architect. Submit samples in accordance with section 01330.

2.2 ACCESSORIES

A. Provide manufacturer’s standard accessories and other special items required for sheet metal roof system installation. Provide accessories with same finish and color as sheet metal roofing.
   1. Trim Items: Same material and finish as roofing panels.
   2. Fasteners: Recommended by roofing system manufacturer for intended purpose.
   4. Sealants: Color coordinated primerless silicone, or high grade, non-drying butyl recommended by panel manufacturer.

B. Underlayment:
   1. Asphalt Saturated Fiberglass: ASTM D 226; Type II (No. 30) asphalt saturated fiberglass roofing felt, nonperforated.

C. Protective Backing Paint: Bituminous.
2.3 DECKING
A. Exterior plywood roof decking structural panels, thickness as shown, as specified in Section 06100.
B. Fasteners: Factory-coated steel fasteners and metal or plastic plates complying with corrosion-resistance provisions in FMG 4470, designed for fastening substrate board to substrate.

2.4 FABRICATION
A. Panels: Full length factory-formed panels, width as specified.
B. Seams: Interlock panel seams entire length of panel, while allowing expansion and contraction movement. Seam shall lock and resist joint disengagement during design wind uplift conditions. Field seam when recommended by manufacturer. Fabricate female leg with pressure equalized capillary break to prevent water siphoning through joints. Provide factory sealant on leading edge of female seam leg for panel-to-panel seal.
C. Clips: Provide UL listed clip designed to allow panels to thermally expand and contract.
D. Use concealed anchors that permit expansion and contraction. Exposed fasteners in panels not permitted.

PART 3 - EXECUTION
3.1 EXAMINATION
A. Examine surfaces and adjacent areas where products will be installed and verify that surfaces conform to product manufacturer's requirements for substrate conditions. Do not proceed until unsatisfactory conditions have been corrected.

3.2 PREPARATION
A. Broom clean substrate deck surfaces immediately before starting installation.

3.3 INSTALLATION
A. Install sheet metal roofing and accessories in accordance with manufacturer's published instructions.
B. Dissimilar Metals: Back paint surfaces in contact with dissimilar materials.
C. Underlayment:
   1. Asphalt Saturated Fiberglass: Apply beneath roof panels over unoccupied spaces. Install over substrate starting at lower point of roof surface, with horizontal overlaps and end laps staggered between layers. Lay parallel to ridge line with minimum 12 inch vertical laps and 6 inch horizontal laps. Install smooth and uniform. Secure in place.
   2. Polyethylene/ Rubberized Asphalt: Apply below SSMR over occupied spaces. Install ice and water shield over entire deck beneath roof panels. Apply in accordance with manufacturer's recommendations.
D. Metal Roof System:
1. Install panels in accordance with manufacturer's published instructions and recommenda-
tions and as defined under this Section.
2. Anchor securely in place using clips and fasteners spaced in accordance with manufac-
turer's recommendations for design wind load criteria. Fasteners shall be of the length
required to penetrate deck a minimum of 3/4 inch.
   a. Install to requirements for UL 90 uplift resistance.
3. Fully seat adjacent panel to achieve continuous engagement of standing seam joint.
4. Align panel seams at valley locations and ridge locations.

   E. Apply sealant to penetrations, transitions, and other locations necessary (not standing seam) for
      airtight, waterproof installation.

3.4 FIELD QUALITY CONTROL

A. Inspect sheet metal roofing system installation for specified material, color, and attachment re-
   quirements. Inspect metal flashings, counter flashings and vents.
B. Correct deficiencies in Work which inspection indicates are not in compliance with Contract re-
   quirements.

3.5 CLEANING

A. Clean exposed surfaces of Work immediately after completion of installation.
B. Clean exposed surfaces of Work 24 hours prior to date of Substantial Completion.

3.6 PROTECTION

A. Provide protection and maintain manufacturer's recommended conditions to prevent damage of
deterioration of sheet metal roofing system until date of Substantial Completion.

END OF SECTION
PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. TPO Membrane Roofing System including insulation.

1.2 REFERENCES

A. The publications listed below form a part of this specification to the extent referenced. Publications are referenced within the text by the basic designation only.

B. ASTM International (ASTM):
   1. ASTM C 578 - Rigid, Cellular Polystyrene Thermal Insulation.
   2. ASTM C 1289 - Faced Rigid Cellular Polyisocyanurate Thermal Insulation Board.
   4. ASTM D 6878 - Thermoplastic Polyolefin Based Sheet Roofing.

C. Factory Mutual Research Corporation (FM):
   2. FM Global Loss Prevention Data Sheet 1-28 - Design Wind Loads.
   3. FM Global Loss Prevention Data Sheet 1-29 - Roof Deck Securement and Above-Deck Components.
   4. FM Approval Standard 4450 - Class 1 Insulated Steel Deck Roofs.
   5. FM Approval Standard 4470 - Class 1 Roof Covers.

D. Underwriters Laboratories, Inc. (UL):
   1. UL - Roofing Materials and Systems Directory.
   2. UL 1256 - Fire Test of Roof Deck Construction.

1.3 ADMINISTRATIVE REQUIREMENTS

A. Pre-installation Conference:
   1. Convene Pre-installation Conference at Site one week prior to commencing work of this Section. Require attendance of parties directly affecting work of this Section, including, but not limited to the following:
      a. Representative.
      b. General Contractor.
      c. Roofing sub-contractor (Roofing Applicator and job foreman).
      d. Mechanical and Plumbing sub-contractors.
      e. Manufacturer's Technical Representative.
   2. Notify attendees at least two weeks prior to the conference.
   3. Review preparation and installation procedures and coordinating and scheduling required with related work.
   4. Review foreseeable methods and procedures related to roofing work, including the following:
      a. Tour, inspect and discuss condition of substrate, roof drains, roof drain final locations, curbs, penetrations and other preparatory work performed by other trades.
      b. Review structural loading limitations of deck as defined below and inspect deck for...
loss of flatness and for required mechanical fastening.

c. Review roofing system requirements (drawings, specifications and other contract documents including submittals).

d. Review required submittals.

e. Review and finalize construction schedule related to roofing work and verify availability of materials, installer's personnel, equipment, and facilities needed to make progress and avoid delays.

f. Review required inspections, testing, certifying, and material usage accounting procedures.

g. Review weather and forecasted weather conditions, and procedures for coping with unfavorable conditions, including possibility of temporary roofing (if not a mandatory requirement).

5. Record discussions of conference and decisions and agreements (or disagreements) reached, and furnish copy of record to each party attending.

1.4 SUBMITTALS

A. Comply with the requirements of Section 01330. Submit required submittals within 30 days after contract award. Submittals shall be available at all times to the Owner’s Construction Manager.

B. Shop Drawings: Submit Shop Drawings showing:
   1. Fastener patterns to meet uplift requirements.
   2. Layouts for Crickets and saddles.
   3. Walk pad layouts.
   4. Details required for completion but not shown on Drawings.
   5. Techniques for nighttime or weather tie offs.

C. Closeout Submittals: Comply with the requirements of Section 01770.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Transport, handle, store, and protect products in compliance with the requirements of Section 01600 and manufacturer's recommendations.

B. Deliver materials in manufacturer's original unopened containers, dry and undamaged with seals and labels intact.

C. Store materials in weather-protected environment, clear of ground and moisture. Storage requirements for insulation are as follows:
   1. Cut or remove plastic shipping wrap from insulation.
   2. Cover with tarpaulin, shield from moistures and ultraviolet rays.
   3. Elevate minimum of 4 inches above substrate.
   4. Secure to resist high winds.
   5. Distribute insulation stored on roof deck to prevent concentrated loads.
   6. Do not install wet insulation. Insulation shall be thoroughly dry prior to installation.

D. Store cements, primers, and caulks in heated area above 40 degrees F during cold weather and in area below 80 degrees F in warm weather.

E. Do not store materials on completed roofing.

1.6 PROJECT CONDITIONS
A. Follow industry standards for environment requirements including, but not limited to, the following:
1. Do not apply roofing membrane during inclement weather. When air temperature is expected to fall below 40 degrees F, follow specified Cold Weather Application Procedures as specified herein.
2. Do not apply finished roofing system to wet, damp or frozen deck surface or when precipitation is occurring.
3. Do not expose materials vulnerable to water or sun damage in quantities greater than can be weatherproofed during same day.

1.7 WARRANTY
A. Provide Warranty commencing at date of certificate of occupancy that includes cost of labor and materials for loss of weather tightness without financial limit for a period of 15 years.

PART 2 - PRODUCTS
2.1 MANUFACTURERS
A. Manufacturers: Subject to compliance with requirements and to the extent specified hereinafter, provide products by the following manufacturers:
1. Carlisle SynTec
2. Firestone Building Products Company
3. Johns Manville Roofing Systems
4. Or Approved Equal.

2.2 SYSTEM DESCRIPTION
A. Single Ply Membrane Roofing System: Single ply membrane roofing system consisting of insulation on metal deck with reinforced membrane mechanically fastened.
B. Flashing and Waterproofing Membranes: Reinforced membrane and unreinforced, fully adhered, as defined herein and indicated on Drawings.

2.3 REGULATORY REQUIREMENTS
A. Regulatory Requirements for Roof Assembly: Comply with FM Approvals Building Materials Approval Guide or Underwriters Laboratories, Inc. Roofing Materials and Systems Directory as specified:
1. Factory Mutual: Provide roofing assembly meeting Class 1A-90 requirements for fire resistance and wind uplift in accordance with FM Approvals Standard 4470 and FM Global Loss Prevention Data Sheet 1-28 and FM Global Loss Prevention Data Sheet 1-29.
2. Provide roof assembly meeting requirements of UL 1256 for Flame Spread developed from underside of deck and roof assembly meeting requirements of FM Approvals Standard 4450 for Class 1 Insulated Steel Deck Roofs (construction materials calorimeter).

2.4 ROOFING SYSTEMS
A. Single Ply Mechanically Attached TPO Membrane Roofing System. Subject to compliance with requirements, provide one of the following products:
1. Sure-Weld Roofing System by Carlisle.
2. UltraPly TPO Roofing System by Firestone.
3. JM TPO Mechanically Fastened Roofing System by Johns Manville.
4. Or Approved Equal.

B. Substitutions: Comply with the requirements of Section 01600.

2.5 ROOF MEMBRANE

A. Roof Membrane: Single ply membrane composed of thermoplastic polyolefin (TPO) sheet as specified for the specific product hereinbefore and reinforced with polyester scrim conforming to ASTM D 6878.
   1. Membrane Type: Reinforced, 60 mil thickness, white, 10 ft. maximum sheet width.

B. Flashing Membrane: Reinforced and non-reinforced TPO membrane and pressure-sensitive flashing by Roofing System manufacturer, thickness to match roofing membrane, specifically designed for use in flashing at perimeters and around projections through roofing system.

2.6 WATERPROOFING MEMBRANE

A. TPO System:
   1. Waterproofing Membrane: Membrane waterproofing composed of thermoplastic polyolefin (TPO) formed into uniform, flexible sheets by Roofing System manufacturer, thickness to match roof membrane.
   2. Waterproofing Flashing: Reinforced and non-reinforced TPO membrane and pressure-sensitive flashing by Roofing System manufacturer, thickness to match membrane, specifically designed for use in flashing at perimeters and wall, and around projections through roofing system.

2.7 ROOF INSULATION

A. Isocyanurate Foam Insulation: Polyisocyanurate board insulation, ASTM C 1289, Type II, felt or glass-fiber mat facer on both major surfaces, with an LTTR (Long Term Thermal Resistance) value of 17.2 based on ASTM C 1303.
   1. Subject to compliance with requirements, provide one of the following products:
      a. HPH by Carlisle.
      b. ISO 95+ GL, by Firestone.
      c. E’NRG’Y 3 or ISO 3 by Johns Manville.
      d. Products meeting the specified requirements by other manufacturers as recommended by the roofing membrane manufacturer.
   2. Thickness: 2.8 inches min.

B. Prefabricated EPS Tapered Insulation: Rigid expanded polystyrene (EPS) foam insulation, ASTM C 578, Type VIII (1.15 pcf minimum) or Type II (1.5 pcf minimum), flame retardant additive, with an LTTR (Long Term Thermal Resistance) value of 20.0 based on ASTM C 1303.
   1. Provide products meeting the specified requirements by one of the manufacturers specified above as applicable.

C. Roof Curb Insulation: Polyisocyanurate Foam; both faces covered with glass fiber felt; thickness to match wood nailer.

2.8 COVER BOARD

A. Cover Board for Application over Prefabricated EPS Tapered Insulation: Glass-mat, water-resistant gypsum roof board, 1/4 inch thick conforming to ASTM C 1177.

2.9 ROOF PENETRATION FLASHING AND SEALS

A. Molded Pipe Flashing: Pre-molded flexible pipe flashing as recommended and supplied by the roofing manufacturer.

B. Urethane Rubber Seal System: Manufacturer’s standard elastomeric pourable sealer pockets including two-part pourable urethane sealer.

2.10 ACCESSORIES

A. Provide accessories as shown on the drawings and manufacturer’s system accessories for a complete and warranted Roofing System, including, but not limited to, the following:
   1. Weathered Membrane Cleaner.
   2. Lap Sealant.
   4. Membrane Fasteners.
   5. Termination Bar.
   6. Insulation Fasteners.
   7. Walkway / Isolation Pads.
   8. Preformed Accessories including pipe flashings.
  10. Draw Bands.
  11. Foam Filler Insulation: Polyurethane Expanding Foam as specified in Section 07900.
  12. Pressure-sensitive Flashing.
  13. Primer.
  15. In-seam Plates.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify deck is clean and smooth, free of depressions, waves, or projections, properly sloped to drains, valleys, and eaves. Verify flutes of steel deck are evenly spaced at intersections. Defects in the substrate surface shall be reported and documented.

B. Verify roof openings, curbs, pipes, sleeves, ducts, or vents through roof are solidly set, cant strips, nailing strips, and reglets are in place. Verify deck is supported and tightly secured.

C. Verify deck surfaces are dry and free of water, snow, and ice.

3.2 PREPARATION

A. Provide covers and other means of protection as necessary to protect building surfaces against damage during roofing work.

B. Where Work shall continue over finished roof membrane, protect roof system from damage.

3.3 INSTALLATION
A. Comply with membrane roofing system and insulation manufacturer's written instructions for installing roof insulation.

3.4 ROOF INSULATION INSTALLATION

A. Mechanically fasten insulation, through fire resistive layer if specified, to deck with FM approved fasteners and plates in accordance with requirements of FM.
   1. Install insulation with long joints of insulation in a continuous straight line with end joints staggered between rows, abutting edges and ends between boards. Fill gaps exceeding 1/4 inch with insulation.
   2. Lay insulation boards such that edges (sides or ends) of board running parallel to the direction of the metal deck flutes are fully supported on the top flange as close as practical to the center of the flange with a minimum bearing of 1 inch. Trim board edges if they veer off the flange center.
   3. Install insulation under area of roofing to achieve required thickness. Where overall insulation thickness is 3 inches or greater, install two or more layers with joints of each succeeding layer staggered from joints of previous layer a minimum of 6 inches in each direction.
   4. Mechanically Fastened Insulation: Install each layer of insulation and secure to deck using mechanical fasteners specifically designed and sized for fastening specified board-type roof insulation to deck type.
   5. Install fasteners using drill with torque clutch; other types of drills will not be permitted.
   6. In no case shall the number of fasteners be less than indicated in approved submittals.

B. Lay insulation boards to moderate contact without forcing joints. Cut insulation to fit neatly around protrusions through roof. At parapet walls, cope insulation around protrusions and embed plates; butt tight to wall, sealing conditioned building.
   1. Fill gaps over 1/4 inch wide with Foam Filler Insulation. After foam sets and before installation of membrane, trim foam flush with insulation surface.

C. Tapered Insulation: Install tapered insulation in accordance with manufacturer's instructions and the following:
   1. Mechanical Unit Crickets and Saddles: Install field-fabricated tapered isocyanurate foam insulation to achieve slope as shown on Drawings but not less than 1/4 inch per foot finished slope.
   2. Roof Counterslope: Where tapered insulation is indicated to counter roof slope, install field-fabricated tapered isocyanurate foam insulation to achieve 1/4 inch per foot min. finished slope.
   3. Edge Taper Insulation: Adjacent to gutter assembly, slope field-fabricated tapered isocyanurate foam insulation at minimum rate of 1/2 inch per foot. Provide insulation having a starting thickness of one inch, tapering insulation up to match nominal roof insulation thickness.

D. Apply no more insulation than can be sealed with membrane in same day.

E. Adhere a single layer of insulation to manufactured metal curbs with bonding cement.

3.5 ROOF MEMBRANE INSTALLATION

A. Mechanically Fastened Membrane:
   1. Run membrane perpendicular to steel deck flutes. Unroll membrane over prepared substrate, lapping adjoining sheets as recommended by manufacturer.
   2. Mechanically fasten membrane using manufacturer's fastening system. Install fasteners in accordance with submitted engineered layout pattern to resist specified wind uplift.
3. Install fasteners using drill depth sensing or torque limiting screw guns to limit under / over drive of fasteners. Drill motors and other non-limiting drivers shall not be used.

4. Seam Sealing: Heat-weld seams according to the system manufacturer's recommendations, and with a minimum weld width of 1-1/2 inches.

B. Cold Weather Application Procedures: When air temperature is expected to fall below 40 degrees F, follow Cold Weather Application Procedures as follows:
1. Store materials in heated storage units prior to installation. Rotate adhesive, cement, and sealant containers to maintain their temperature above 40 degrees F.
2. Allow membrane to relax until no wrinkles are visible.
3. Allow adequate time for solvents in cements to flash off. Check dryness of applied cements before sealing joints.
4. Verify that frost, dew, and other forms of moisture have evaporated prior to covering insulation with membrane to prevent entrapment of moisture within finished roof system.

3.6 WATER CUTOFFS AND WEATHER PROTECTION

A. Install water cut-offs at end of day's operation to seal insulation and edge of roof membrane from moisture entry. If inclement weather appears imminent during roofing application, cease operations and protect deck, insulation, flashings, penetrations and membrane from moisture infiltration with water cutoffs. Insulation and roofing materials not so protected prior to inclement weather will be considered damaged and will be cause for rejection.

B. Remove water cut-offs and other temporary weather protections prior to continuing roofing work. Remove materials that have been subject to moisture damage and return deck to a clean, dry condition before proceeding with roofing operations. Remove damaged materials from job site.

C. The water cut-offs and weather protection shall not be considered a part of the final roof system specified.

3.7 FLASHING MEMBRANE AND ACCESSORIES INSTALLATION

A. Flashing Membrane: Apply flexible flashings to seal membrane to vertical elements using manufacturer's standard peel and stick flashing.
1. Reinforced Flashing Membrane: Where conditions permit, flash penetrations and walls with reinforced flashing membrane.
2. Uncured Flashing: Limit use of uncured flashing to overlay vertical seams as required at angle changes, to flash inside and outside corners, scuppers, and other penetrations or unusually shaped walls as approved by the manufacturer.

B. Roof Penetrations:
1. Molded Pipe Flashing: Install where shown and elsewhere whenever configuration of penetration will permit except when urethane rubber seals is shown.
2. Urethane Rubber Seal System: Install at locations shown including electrical, gas line, condensate pipe, and flue penetrations. Install also where molded pipe flashing cannot be installed due to configuration of penetration.
3. Install flashings and seals per manufacturer's application instructions.
4. Comply with manufacturers recommendations for flashing for pipe penetrations larger than 6 inches.

C. Seal flashings and flanges of items penetrating membrane.

D. Fasten termination bars at 12 inches on center or less to maintain constant compression.
E. Isolation Pads: Install isolation pads at pipe supports.

F. Walkway Pads: Install walkway pads as required to provide an accessible path from roof ladder to and around each roof top unit. Maximum pad section length shall be 10 ft with three inch spacing between pad sections, unless indicated otherwise on Drawings. Adhere pads to roofing system to prevent displacement in maximum anticipated design wind velocity and to allow drainage of moisture from beneath pads. Install pads to allow roof surface drainage without ponding water. Install pads after adjacent equipment installation.

3.8 WATERPROOFING MEMBRANE INSTALLATION

A. Waterproofing Membrane: Install waterproofing membrane to be fully adhered to parapet using bonding adhesive as recommended by membrane manufacturer. Run membrane waterproofing over top of parapet and turn down front side of parapet 3 inches.

1. Provide continuous weather tight seal from 3 inches below parapet cap, over parapet, down interior face, and onto roof surface.

2. Conceal adhesive on exterior face of parapet with waterproofing.

3.9 WATERPROOFING FLASHING INSTALLATION

A. Waterproofing Flashing: Apply waterproofing flashing to seal membrane to vertical elements using manufacturer’s peel and stick flashing.

B. Comply with the following requirements when using TPO waterproofing flashing:

1. Reinforced Waterproofing Flashing: Where conditions permit, flash walls with reinforced waterproofing flashing or as required by the manufacturer.

2. Uncured Flashing: Limit use of uncured flashing to overlay vertical seams as required at angle changes, to flash inside and outside corners, scuppers, and other penetrations or unusually shaped walls where use of reinforced waterproofing flashing is not practical or as required by the manufacturer.

3.10 INTERFACE WITH OTHER WORK

A. Coordinate Work with installation of associated metal counterflashings specified under other sections as the Work of this Section proceeds.

B. Complete installation of base flashing at roof curbs prior to setting roof top equipment.

3.11 FIELD QUALITY CONTROL

A. Core samples shall be taken when required to evaluate problems observed during quality control inspections of roofing membrane as follows:

1. Cut samples shall be taken when and as recommended by the Manufacturer’s Technical Representative, and approved by the Owner’s Representative, when determined necessary for quality control validation or to determine the extent of deficiencies discovered during construction or during final roofing inspection. Except where cut samples are taken to investigate deficiencies, no more than two cut samples per 100 squares or one cut sample from each day’s work shall be required. Cut samples at locations identified by the Manufacturer’s Technical Representative.

2. Submit core samples to the Manufacturer’s Technical Representative for examination. Deficiencies shall be reported by the Manufacturer’s Technical Representative.

B. Manufacturer Services:

1. Engage Manufacturer’s Technical Representative to provide site inspection and reports.
2. Inspection by the Manufacturer’s Technical Representative shall include the following:
   a. Periodic site visits during the roof installation as many times as necessary to ensure adequate observations and proper installation but at least at the following milestones.
      
      1.) After 30% but prior to 50% of roof installation.
      2.) At 100% completion of roof installation.
      3.) Final Inspection: Two weeks prior to owner acceptance.
   b. Field reports.
   c. Field testing recommendations.
   d. Oversight of remedial repairs in the field.
   e. Verification of completion of magnetic sweeping prior owner acceptance.
   f. Conducting comprehensive roof inspection upon completion of roofing together with all parties to be signators to Roof Inspection.
   g. Issuance of Certification of Quality of Roof Construction upon completion of roof installation.

3.12 CLEANING

   A. Replace defaced or disfigured finishes caused by Work of this Section.
   
   B. Sweep entire roof surface with a magnetic sweeper to remove nails, screws and other metal items which may cause subsequent damage to the roof.

3.13 PROTECTION

   A. Where construction traffic must continue over finished roof installation, protect roof surfaces as recommended by roofing system manufacturer to protect manufacturer’s warranty.

3.14 MAINTENANCE AND REPAIR DURING CONSTRUCTION

   A. Maintain roofing system and related work from time of roofing completion to owner acceptance. Repair material or installation defects or damage resulting from any subsequent work on the roof or from any weather-related damage. Maintain roof system in watertight condition including repair of conditions that show signs of inferior workmanship that may result in potential leaks. Repair leaks occurring prior to owner acceptance accordance with good roofing practice and the requirements specified herein. Remove and replace wet insulation caused by water leaks and repair the roofing system.

END OF SECTION
PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Metal soffit panels.

B. Related Sections:
   1. Section 05400 - Cold Formed Metal Framing: Steel framing supporting metal soffit.

1.2 REFERENCES

A. The publications listed below form a part of this specification to the extent referenced. Publications are referenced within the text by the basic designation only.

B. American Architectural Manufacturer's Association (AAMA):
   1. AAMA 2605 - Specifications, Performance Requirements And Test Procedures For Superior Performing Organic Coatings And Aluminum Extrusions And Panels.

C. ASTM International (ASTM):
   1. ASTM A 755/A - Steel Sheet, Metallic Coated by the Hot-Dip Process and Prepainted by the Coil-Coating Process for Exterior Exposed Building Products.
   2. ASTM A 792/A - Steel Sheet, 55% Aluminum-Zinc Alloy-Coated by the Hot-Dip Process.

1.3 DELIVERY, STORAGE AND HANDLING

A. Section 01600 - Product Requirements: Transport, handle, store, and protect products.

B. Protect panels from accelerated weathering by removing or venting sheet plastic shipping wrap.

C. Deliver panels to site in dry and undamaged condition. Unload and handle in accordance with manufacturer's published instructions.

D. Store panels off ground protected from weather, to prevent twisting, bending, or abrasion, and to provide ventilation.

PART 2 - PRODUCTS

2.1 METAL SOFFIT

A. Metallic-Coated Steel Sheet:
   1. Steel Sheet with Organic Coating Finish: Steel sheet metallic coated by the hot-dip process and prepainted by the coil-coating process to comply with ASTM A 755.
   2. Steel Sheet with Aluminum or Galvalume Finish: Aluminum-Zinc Alloy-Coated Steel Sheet: ASTM A 792, Class AZ50 coating designation, Grade 40; structural quality.

B. Manufacturer: Subject to compliance with requirements, provide product equivalent to those specified by any one of the following manufacturers:
   1. AEP-SPAN; Dallas, TX; (800) 527-2503.
   2. Berridge Manufacturing Co., Houston, TX; (800) 231-8127.
   3. Fabral Metal Roof and Wall Systems, Lancaster, PA (800) 884-4484.
   4. MBCI: Houston, TX; (800) 861-6224
   5. McElroy Metal, Bossier City, LA, (800) 950-6531.
   6. PAC-CLAD, Petersen Aluminum Corporation, Elk Grove Village, IL (800) 722--2523.
C. Description:

2.2 ACCESSORIES
A. Provide manufacturer's standard accessories and other special items required and essential to completeness of soffit installation. Sight-exposed accessories shall match finish of metal soffit system.
   1. Trim Items: Of same material and finish as soffit sheets.
   2. Fasteners: As recommended by soffit system manufacturer for intended purpose.
   3. Sealants: Color coordinated primerless silicone or high grade non-drying butyl, recommended by panel manufacturer.

2.3 FABRICATION
A. Factory fabricate and finish panels and accessories ready for field assembly.
B. Form sections true to shape, accurate in size, square, and free from distortion.
C. Fabricate panels in one piece. Fabricate accessories in longest practicable lengths.

2.4 FINISHES
A. Factory finish surfaces with high performance pigmented organic coating. Prepare, pretreat, and apply coating to exposed metal surfaces in conformance with coating and resin manufacturer's instructions providing finish free of scratches and other blemishes.
   1. Finish: Manufacturer's standard 2-coat, thermocured system composed of specially formulated inhibitive primer and fluoropolymer color topcoat containing minimum of 70 percent Penwalt Kynar 500 resin by weight with total minimum dry film thickness of 1.0 mil and 30 percent reflective gloss when tested in accordance with ASTM D 523 and complying with physical properties and coating performance requirements of AAMA 2605, except Humidity Resistance and Salt Spray Resistance shall be 2000 hours.
   2. Color: To be selected by architect.

PART 3 - EXECUTION
3.1 EXAMINATION
A. Examine building structure and adjacent areas where panels will be installed. Do not proceed with Work until unsatisfactory conditions have been corrected.
   1. Examine soffit structure to verify that structure is ready for soffit panel installation.
   2. Verify field dimensions to determine compliance with panel manufacturer's tolerances.
B. Beginning of installation indicates acceptance of existing conditions.

3.2 INSTALLATION
A. Install soffit panels in accordance with manufacturer's published instructions.
B. Secure panel in place with concealed fasteners.
C. Interlock panels and secure in place to prevent warping and wracking.
D. Back paint surfaces in contact with dissimilar materials.
3.3 FIELD QUALITY CONTROL

A. Inspect soffit panel installation, alignment, attachments, trim, and accessories.

3.4 CLEANING

A. Wipe clean each soffit panel after erection.

B. Replace damaged panels and other components of Work which cannot be repaired by finish touch-up or similar minor repairs.

C. Remove from finished surface, filing caused by drilling and cutting of panels.

END OF SECTION
PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Fascia trim.
   2. Counterflashing over base flashing.

B. Related Sections:
   1. Section 04200 - Unit Masonry Assemblies: Metal reglets and through-wall flashing for masonry.
   2. Section 06100 - Rough Carpentry: Wood blocking and nailers.
   3. Section 07711 - Gutters and Downspouts.
   4. Section 07901 - Joint Sealants.
   5. Section 09900 - Painting.

1.2 REFERENCES

A. The publications listed below form a part of this specification to the extent referenced. Publications are referenced within the text by the basic designation only.

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

C. ASTM International (ASTM):
   1. ASTM A 653 - Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.
   2. ASTM A 755/A - Steel Sheet, Metallic Coated by the Hot-Dip Process and Prepainted by the Coil-Coating Process for Exterior Exposed Building Products.
   3. ASTM A 792/A - Steel Sheet, 55% Aluminum-Zinc Alloy-Coated by the Hot-Dip Process.
   4. ASTM B 749 - Lead and Lead Alloy Strip, Sheet, and Plate Products.

D. National Roofing Contractors Association (NRCA):

E. Sheet Metal and Air Conditioning Contractors National Association (SMACNA):

F. Steel Structures Painting Council (SSPC):
   1. SSPC-Paint 12 - Cold-Applied Asphalt Mastic (Extra Thick Film).

1.3 SUBMITTALS

A. Contract Closeout Submittals: Submit the following under provisions of Section 01770.

1.4 QUALITY ASSURANCE

B. Supplier Certification: Provide certification from galvanized sheet steel supplier stating that materials conform to ASTM A 653, G90 hot-dipped galvanized steel.

1.5 DELIVERY, STORAGE AND HANDLING

A. Stack preformed material to prevent twisting, bending, or abrasion, and to provide ventilation.

B. Prevent contact with materials during storage that may cause discoloration, staining, or damage.

PART 2 - PRODUCTS

2.1 SHEET MATERIALS

A. Galvanized Steel: ASTM A 653 Commercial Quality and Lock-Forming Quality, G90 coating designation hot-dip galvanized, mill phosphatized for painting where exposed to view from ground level. Sheet metal gages shall be as shown or as follows where not shown:
   1. Flashing and Counter Flashing: 24 gage.
   2. Fascia Trim: 24 gage.

2.2 ACCESSORIES

A. Fasteners: Galvanized steel finish exposed fasteners to match flashing metal. Furnish exposed fasteners with soft EPDM washers as manufactured by the following:
   1. Tap - Fast Screws, by Hilti.
   2. Trugrip GT, by ITW Buildex.

B. Sealant: Specified in Section 07901.

C. Bituminous Coating: SSPC - Paint 12, solvent-type bituminous mastic, nominally free of sulfur, compounded for 15 mil dry film thickness per coat.

D. Draw Band: Stainless steel.

2.3 FABRICATION

A. Form sections true to shape, accurate in size, square, and free from distortion or defects.

B. Fabricate cleats of same material as sheet, interlockable with sheet.

C. Form pieces in longest possible lengths.

D. Hem exposed edges on underside 1/2 inch; miter and seam corners.

E. Fabricate corners to form one piece with minimum 18 inches long legs; rivet for rigidity.

F. Fabricate vertical faces with bottom edge formed outward 1/4 inch and hemmed to form drip.

G. Fabricate flashings to allow toe to extend 4 inches over roofing. Return and brake edges.

H. Fabricate exposed sheet metal components with provisions for thermal expansion.

2.4 FINISH

A. Fascia Trim: Prefinished to match Standing Seam Metal Roof as selected by Architect.
B. Flashing and counterflashing: Paint metal surfaces exposed to view from ground level in accordance with Section 09900, and as indicated on Drawings, unless otherwise shown to be prefinished.

PART 3 - EXECUTION

3.1 INSPECTION

A. Verify roof openings, curbs, pipes, sleeves, ducts, or vents through roof are solidly set.

B. Verify roofing membrane termination and base flashings are in place, sealed, and secure.

C. Beginning of installation means acceptance of existing conditions.

3.2 PREPARATION

A. Field measure site conditions prior to fabricating work.

B. Install starter and edge strips, and cleats before starting installation.

3.3 INSTALLATION

A. Install sheet metal flashing and trim in accordance with applicable details of SMACNA "Architectural Sheet Metal Manual" and NRCA "Low Slope Roofing Manual." Anchor units of work securely in place by methods indicated, providing for thermal expansion of metal units; conceal fasteners where possible, and set units true to line and level. Install work with laps, joints, and seams that will be permanently watertight and weatherproof.

B. Bed flanges of metal flashings in plastic cement or sealing mastic where required for waterproof performance.

C. Apply bituminous coating on surfaces in contact with dissimilar materials including the following:
   1. Dissimilar metals as defined in SMACNA Appendix A-3.
   2. Preservative treated wood.

D. Reglet and Counterflashing System:
   1. Surfaced Mounted Reglet:
      a. Set reglet parallel to roof line in full bed of sealant. Provide minimum 2 inch end lap at continuous elevations.
      b. Secure to wall with neoprene/stainless steel washers and drive pins at maximum 16 inches on center.
      c. Provide a continuous, full bead of sealant at top edge of reglet between flashing and wall. Sealant bead shall be of sufficient width to provide a 45 degree angle with vertical surface.
   3. Counterflashing: Provide counterflashing of the type indicated or required to match reglet system. Insert counterflashings into reglets to form tight fit. Counterflashing shall be installed in such a manner as to provide for continuous contact at base flashing with sufficient pressure at point of contact to prevent dislocation. Lap inside corners. Notch and hook-seam outside corners. Set laps and seams in sealant.
      a. Provide minimum 2" end lap at continuous elevations.
      b. Change in elevation of 4", provide 8" end lap.
      c. Change in elevation of 8", provide 12" end lap.

END OF SECTION
PART 1 GENERAL

1.1 RELATED DOCUMENTS
A. Drawings and general provisions of the Contract, including General and Special Conditions apply to this Section.

1.2 SUMMARY
A. This section includes, but is not limited to:
   1. Manufactured curbs.

1.3 RELATED SECTIONS
A. Section 05300 – Steel Deck.

1.4 REFERENCES

1.5 SUBMITTALS
A. Product Data: Manufacturer's data sheets on each product to be used, including:
   1. Preparation instructions and recommendations.
   2. Storage and handling requirements and recommendations.
   3. Installation methods.
   4. Maintenance requirements.

1.6 DELIVERY, STORAGE, AND PROTECTION
A. Store products in manufacturer's unopened packaging until ready for installation.
B. Store products under cover and elevated above grade.
PART 2 PRODUCTS

2.1 MANUFACTURED CURBS

A. Manufactured Curbs, Equipment Rails, and Other Roof Mounting Assemblies: Factory-assembled hollow sheet metal construction with fully mitered and welded corners, integral counterflashing, internal reinforcing, and top side and edges formed to shed water.

1. Sheet Metal: Hot-dip zinc coated steel sheet complying with ASTM A 653/A 653M, SS Grade 33 (230); G60 (Z180) coating designation; 18 gage, 0.048 inch (1.21 mm) thick.

2. Roofing Cants: Provide integral sheet metal roofing cants dimensioned to begin slope at top of roofing insulation; 1:1 slope; minimum cant height 4 inches (200 mm).

3. Manufacture curb bottom and mounting flanges for installation directly on roof deck, not on insulation; match slope and configuration of roof deck.

4. Provide the layouts and configurations shown on the drawings.

B. Curbs Adjacent to Roof Openings: Provide curb on all sides of opening, with top of curb horizontal for equipment mounting.

1. Provide preservative treated wood nailers along top of curb.

2. Insulate inside curbs with 1-1/2 inch (38 mm) thick fiberglass insulation.

3. Height Above Finished Roof Surface: 6 inches (152 mm), minimum.

4. Height Above Roof Deck: 14 inches (356 mm), minimum.

PART 3 EXECUTION

3.1 EXAMINATION

A. Do not begin installation until substrates have been properly prepared.

B. If substrate preparation is the responsibility of another installer, notify Architect of unsatisfactory preparation before proceeding.

3.2 PREPARATION

A. Clean surfaces thoroughly prior to installation.

B. Prepare surfaces using the methods recommended by the manufacturer for achieving the best result for the substrate under the project conditions.
3.3 INSTALLATION
A. Install in accordance with manufacturer's instructions, in manner that maintains roofing weather integrity.

3.4 CLEANING AND PROTECTION
A. Clean installed work to like-new condition.
B. Protect installed products until completion of project.
C. Touch-up, repair or replace damaged products before Substantial Completion

END OF SECTION
PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Galvanized steel gutters and downspouts, with expansion joints.
   2. Downspout collectors.
   3. Conductor heads.

B. Related Sections:
   1. Section 07620 - Sheet Metal Flashings and Trim.
   2. Section 07901 - Joint Sealants.
   3. Section 09900 - Painting: Field painting of metal surfaces.

1.2 REFERENCES

A. The publications listed below form a part of this specification to the extent referenced. Publications are referenced within the text by the basic designation only.

B. ASTM International (ASTM):
   2. ASTM A 283 - Low and Intermediate Tensile Strength Carbon Steel Plates.
   3. ASTM A 653 - Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.

C. Sheet Metal and Air Conditioning Contractors National Association (SMACNA):

D. Steel Structures Painting Council (SSPC):
   1. SSPC - Paint 12 - Cold-Applied Asphalt Mastic (Extra Thick Film).

1.3 QUALITY ASSURANCE

A. Nominal sizing of components for rainfall intensity determined by a storm occurrence of 1 in 5 years shall be as indicated on Drawings.

1.4 DELIVERY, STORAGE AND HANDLING

A. Stack preformed materials to prevent twisting, bending, or abrasion, and to aid ventilation. Slope to drain.

B. Prevent contact with materials during storage which may cause discoloration, staining, or damage.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Galvanized Steel Sheet: ASTM A 653 Structural Quality, Grade 33, G90 zinc coating.

B. Galvanized Steel Plate: ASTM A 283, Grade A; hot-dipped galvanized G90 coating complying with ASTM A123.

2.2 COMPONENTS
A. Hanging Gutters: Fabricate to cross section indicated, complete with end pieces, outlet tubes, and other accessories as required. Fabricate in minimum 96-inch long sections. Furnish flat-stock gutter spacers and gutter brackets fabricated from same metal as gutters, of size recommended by SMACNA but not less than twice the gutter thickness. Fabricate expansion joints, expansion-joint covers, and gutter accessories from same metal as gutters. SMACNA rectangular profile, Figure 1-2, Style D, gauge as follows:
1. 6”x 6”: 24 gauge.

B. Downspouts: 22 gauge; SMACNA rectangular. Fabricate downspouts complete with mitered elbows. Furnish with metal hangers, from same material as downspouts, and anchors. Downspouts shall be fully enclosed profile, Figure 1-32B.

C. Conductor Head: SMACNA Figure 1-25F.

2.3 ACCESSORIES

A. Gutter Brackets: Galvanized steel plate, 3/16 inch thick by 2 inches wide bent plate.
B. Gutter Spacer Clip: Galvanized steel sheet, gauge to match gutter.
C. Gutter Strap: Galvanized steel sheet size and spacing as shown.
D. Downspout/Gutter Connections: SMACNA rectangular profile, Figure 1-33B, Detail 1, gauge to match gutter.
E. Downspout Straps: Galvanized steel sheet; 20 gauge, SMACNA Figure 1-35G.
F. Bituminous Coating: SSPC - Paint 12, solvent-type bituminous mastic, nominally free of sulfur, compounded for 15 mil dry film thickness per coat.
G. Sealant: Specified in Section 07901.
H. Splash Blocks (if indicated on Drawings): Precast concrete units, minimum 3000 psi at 28 days, with 5 percent air entrainment, size and profile to suit application.
I. Downspout Collectors (if indicated on Drawings): Pipe material, sizes, connections, dimensions and profiles to suit downspouts and underground storm drainage system as indicated on drawings.

2.4 FABRICATION

A. Form gutters and downspouts of size indicated on Drawings.
B. Fabricate in accordance with SMACNA details unless otherwise shown.
C. Provide gutter spacers at spacing shown. Fasten to front and back of gutter.
D. Field measure site conditions prior to fabricating work.
E. Form sections square, true, and accurate in size, in maximum possible lengths and free of distortion or defects detrimental to appearance or performance. Allow for expansion at joints.
F. Hem exposed edges of metal.
G. Field Finishing (if indicated on Drawings to be painted): Field paint gutter, downspouts, and accessories surfaces exposed to view from ground surface. Paint in accordance with Section 09900.

H. Factory Finish (if indicated on Drawings to be prefinished): Kynar finish shall be equal to finish of metal roof panels specified in Section 07412.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify that surfaces are ready to receive work and conditions are acceptable.

B. Verify surfaces behind gutters and downspouts are painted prior to installation. Gutters, downspouts, and conductor heads shall not be in place while surfaces behind such items are being painted.

C. Beginning of installation indicates acceptance of existing conditions and substrate.

3.2 INSTALLATION

A. Install gutters, brackets, and accessories in accordance with SMACNA Figure 1-12 and as shown on the Drawings.
   1. Install gutters level without sags or dips to prevent ponding.
   2. Gutter Brackets: Space alternately with gutter spacers at 36 inches on center.
      a. Attachment to Masonry: Anchor to masonry bond beam as shown. Space anchor bolts minimum of 3 inches apart.
      b. Attachment to Steel: Weld to steel tube section with 3/16 inch by 2 inches fillet weld, both sides of bracket. Begin weld at top of bracket.
   3. Lap gutter joints 2 inches, set laps in bead of sealant, and rivet at 1 inch on center.
   4. Provide lap type gutter expansion joint in accordance with SMACNA Figure 1-6. Locate joints at a maximum spacing of 40 feet with at least one expansion joints in each segment of gutter between ends and/or downspouts.

B. Install downspouts in accordance with SMACNA Figure 1-35A, space straps at 48 inches on center.

C. Install conductor heads and downspouts after application of exterior wall coating.

D. Apply bituminous coating on surfaces in contact with dissimilar materials including the following:
   1. Dissimilar metals as defined in SMACNA Appendix A-3 and backside of conductor heads, gutters and downspouts.
   2. Preservative treated wood.

END OF SECTION
PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Firestopping in rated assemblies.

1.2 REFERENCES

A. The publications listed below form a part of this specification to the extent referenced. Publications are referenced within the text by the basic designation only.

B. ASTM International (ASTM):
   1. ASTM E 84 - Surface Burning Characteristics of Building Materials
   2. ASTM E 814 - Fire Tests of Through Penetration Fire Stops.

C. Underwriters' Laboratories, Inc. (UL):
   1. UL 1479 - Fire Tests of Through-Penetration Firestops.
   3. UL Fire Resistance Directory:

1.3 SUBMITTALS

A. Certifications:
   1. Certifications of installer qualifications.
   2. Certification of manufacturer’s inspection.

1.4 CONTRACTOR QUALIFICATIONS

A. Installation of firestopping shall be by a Designated Responsible Individual (DRI) in accordance with FM 4991 or shall be an approved installer by the Firestop Manufacturer. Submit documentation of the DRI or a letter from the manufacturer naming the approved installer to the Architect prior to commencement of firestop work.

1.5 ENVIRONMENTAL REQUIREMENTS

A. During application of caulk and putty, keep away from heat, open flame, sparks, or other sources of ignition until product cures. Use only with adequate ventilation.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Subject to compliance with requirements, provide firestopping products as manufactured by one of the following:
   1. Nelson Firestop Products, (800) 331-7325.
   3. The RectorSeal Corporation, (800) 231-3345.
4. Specified Technologies, Inc. (STI), (800) 992-1180.
5. 3M Fire Protection Products, (800) 376-0964.

2.2 MATERIALS

A. Firestop materials shall have been tested with and shall be in compliance with the minimum requirements of ASTM E814, UL 1479, and UL 2079 as applicable. Products used shall be as listed below as suitable for the intended application and as required to produce the fire rating as shown on the drawings and to conform to the Firestopping Schedule of UL assemblies included at the end of this Section.

B. Intumescent Latex or Acrylic Sealant: Single-component, intumescent, latex or acrylic formulation.
   1. LBS by Nelson Firestop Products.
   2. FS ONE or CP 606 by Hilti.
   3. Metacauulk 950 or 1000 by RectorSeal.
   4. SpecSeal SSS100 by STI.
   5. CP 25WB+, IC 15WB, or 3000WT by 3M.
   6. TREMstop Intumescent Acrylic (IA) or Acrylic (A) by Tremco.

C. Intumescent Solvent-Release-Curing Sealant: Single component, intumescent, synthetic-polymer based, non-sag grade.
   1. CP 25N/S by 3M.

D. Intumescent Wrap/Strip: Single-component, elastomeric sheet with aluminum foil on one face.
   1. WRS by Nelson Firestop Products.
   2. CP 645 Wrap Strip by Hilti.
   3. Metacauulk Wrap Strip by RectorSeal.
   4. SpecSeal SSWRED Wrapstrip by STI.
   5. FS-195+ Wrap/Strip or Ultra GS by 3M.
   6. TREMstop WS by Tremco.

E. Intumescent Putty: Single-component, non-hardening, dielectric, intumescent putty.
   1. FSP by Nelson Firestop Products.
   2. CP 618 Putty Stick or CP 617/617L Putty Pad by Hilti.
   3. CP 645 Wrap Strip by Hilti.
   4. CP 658 Firestop Plug by Hilti.
   5. Metacauulk Fire Rated Putty by RectorSeal.
   6. SpecSeal Putty by STI.
   7. Moldable Putty+ by 3M.
   8. TREMstop MP (Moldable Putty) or Putty Stick by Tremco.

F. Silicone Sealant: Single-component, moisture-curing, silicone-based elastomeric, non-sag grade.
   1. CLK N/S by Nelson Firestop Products.
   2. CP 601S by Hilti.
   3. Metacauulk 835 by RectorSeal.
   4. SpecSeal PEN 300 by STI.
   5. 2000+ Silicone by 3M.
   6. FYRE-SIL or SL by Tremco.
G. Silicone or Polyurethane Foam: Two-Component, liquid elastomer that, when mixed, expands and cures in place to produce a flexible, nonshrinking foam.
   1. SpecSeal PEN 200 by STI.
   2. 2001 Silicone RTV Foam by 3M.
   3. CP 620 Fire Foam by Hilti.

H. Intumescent Collar: Factory-fabricated, intumescent collar.
   1. PCS by Nelson Firestop Products.
   2. CP 642 or CP 643 by Hilti.
   3. Metacaulk Pipe Collar by RectorSeal.
   4. SpecSeal SSC Collars by STI.
   5. Plastic Pipe Device, RC Pack, or RC One Collar by 3M.
   6. TREMstop D by Tremco.

I. Intumescent Composite Sheet, Pillows and Mortar, or Blocks: Products used to firestop large openings.
   1. CPS by Nelson Firestop Products.
   2. FS 657 Fireblocks by Hilti.
   3. CP 637 Firestop Mortar by Hilti.
   4. CP 675T Firestop Board by Hilti.
   5. SpecSeal SSB Pillows and SpecSeal SSM Firestop Compound by STI.
   6. CS-195+ Composite Sheet by 3M.
   7. TREMstop PS by Tremco.

J. Sprayable Fire-Rated Mastic: Products used to firestop construction joints.
   1. CP672 Speed Spray by Hilti.
   2. Specseal Elastomeric Spray by STI.
   3. Firedam Spray 200 by 3M.
   4. TREMstop Acrylic Spray (A-SP) by Tremco.

K. Packing Material: Manufacturer's standard mastic, putty, ceramic fiber blanket, or mineral wool to be used as fill or backing material for firestopping.
   1. FSB or Mineral Wool by Nelson Firestop Products.
   3. Fire Safing or Backer Rod by RectorSeal.
   4. Mineral Wool by STI.
   5. Fire Barrier 5A, 15A, and 20A or PM4 Packing Material by 3M.
   6. TREMstop FS Blanket by Tremco.
   7. CP 777 Speed Plugs by Hilti. (preformed mineral wool designed for top of wall fluted metal deck packing material)

L. Substitutions: Not Permitted.

PART 3 - EXECUTION

3.1 PREPARATION

A. Remove loose dirt and oil from penetration surfaces.

B. Place hangers or damming materials in penetration to hold firestopping materials, if necessary.
3.2 INSTALLATION

A. Follow manufacturer charts for appropriate material to achieve required fire rating in various locations.

B. Install firestopping at penetrations of fire rated wall materials in accordance with manufacturer's published instructions.

C. Install firestopping at penetrations and construction joints of fire rated walls and floors in accordance with manufacturer's published instructions and in accordance with UL Fire Resistance Directory.

3.3 FIELD QUALITY CONTROL

A. Site Inspection: Upon completion of installation, inspection of installed firestopping shall be made by a qualified manufacturer’s representative to verify work complies with the manufacturers requirements. Submit written certification to the Architect that Manufacturer has visited the site and the work is in accordance with manufacturer's requirements and published instructions.

3.4 SCHEDULES

A. Provide firestopping complying with UL assemblies specified below.

<table>
<thead>
<tr>
<th>Penetration</th>
<th>Assembly</th>
<th>Nelson</th>
<th>Hilti</th>
<th>RectorSeal</th>
<th>STI</th>
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**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 joint sealants for the following locations:

1. Exterior joints in vertical surfaces and non-traffic horizontal surfaces as indicated below:
   a. Control and expansion joints in unit masonry.
   b. Perimeter joints between materials listed above and frames of doors and windows.
   c. Other joints as indicated.

2. Exterior joints in horizontal traffic surfaces as indicated below:
   a. Control, expansion, and isolation joints in cast-in-place concrete slabs.
   b. Other joints as indicated.

3. Interior joints in vertical surfaces and horizontal nontraffic surfaces as indicated below:
   a. Perimeter joints of exterior openings where indicated.
   b. Tile control and expansion joints.
   c. Vertical control joints on exposed surfaces of interior unit masonry and concrete walls and partitions.
   d. Perimeter joints between interior wall surfaces and frames of interior doors, windows, and elevator entrances.
   e. Perimeter joints of toilet fixtures.
   f. Other joints as indicated.

4. Interior joints in horizontal traffic surfaces as indicated below:
   a. Control and expansion joints in cast-in-place concrete slabs.
   c. Control and expansion joints in tile flooring.
   d. Other joints as indicated.

1.3 SYSTEM PERFORMANCE REQUIREMENTS

A. Provide elastomeric joint sealants that have been produced and installed to establish and to maintain watertight and airtight continuous seals without causing staining or deterioration of joint substrates.

B. Provide joint sealants for interior applications that have been produced and installed to establish and maintain airtight continuous seals that are water resistant and cause no staining or deterioration of joint substrates.

1.4 SUBMITTALS

A. General: Submit the following in accordance with Conditions of Contract and Division 1 Specification Sections.

B. Product data from manufacturers for each joint sealant product required.
   1. Certification by joint sealant manufacturer that sealants plus the primers and cleaners required for sealant installation comply with local regulations controlling use of volatile organic compounds.
C. Samples for verification purposes of each type and color of joint sealant required. Install joint sealant samples in 1/2-inch (13-mm) wide joints formed between two 6-inch (150-mm) long strips of material matching the appearance of exposed surfaces adjacent to joint sealants.

D. Compatibility and adhesion test reports from elastomeric sealant manufacturer indicating that materials forming joint substrates and joint sealant backings have been tested for compatibility and adhesion with joint sealants. Include sealant manufacturer's interpretation of test results relative to sealant performance and recommendations for primers and substrate preparation needed to obtain adhesion.

E. Product test reports for each type of joint sealants indicated, evidencing compliance with requirements specified.

1.5 QUALITY ASSURANCE

A. Installer Qualifications: Engage an experienced Installer who has completed joint sealant applications similar in material, design, and extent to that indicated for Project that have resulted in construction with a record of successful in-service performance.

B. Single Source Responsibility for Joint Sealant Materials: Obtain joint sealant materials from a single manufacturer for each different product required.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Deliver materials to Project site in original unopened containers or bundles with labels indicating manufacturer, product name and designation, color, expiration period for use, pot life, curing time, and mixing instructions for multi-component materials.

B. Store and handle materials in compliance with manufacturer's recommendations to prevent their deterioration or damage due to moisture, high or low temperatures, contaminants, or other causes.

1.7 PROJECT CONDITIONS

A. Environmental Conditions: Do not proceed with installation of joint sealants under the following conditions:
   1. When ambient and substrate temperature conditions are outside the limits permitted by joint sealant manufacturer.
   2. When ambient and substrate temperature conditions are outside the limits permitted by joint sealant manufacturer or below 40 deg F (4 deg C).
   3. When joint substrates are wet.

B. Joint Width Conditions: Do not proceed with installation of joint sealants where joint widths are less than allowed by joint sealant manufacturer for application indicated.

C. Joint Substrate Conditions: Do not proceed with installation of joint sealants until contaminants capable of interfering with their adhesion are removed from joint substrates.

1.8 SEQUENCING AND SCHEDULING

A. Sequence installation of joint sealants to occur not less than 21 nor more than 30 days after completion of waterproofing, unless otherwise indicated.
PART 2 - PRODUCTS

2.1 MATERIALS, GENERAL

A. Compatibility: Provide joint sealants, joint fillers, and other related materials that are compatible with one another and with joint substrates under conditions of service and application, as demonstrated by sealant manufacturer based on testing and field experience.

B. Colors: Provide color of exposed joint sealants to comply with the following:
   1. Provide selections made by Architect from manufacturer's full range of standard colors for products of type indicated.

2.2 ELASTOMERIC JOINT SEALANTS

A. Elastomeric Sealant Standard: Provide manufacturer's standard chemically curing elastomeric sealants that comply with ASTM C 920 and other requirements indicated on each Elastomeric Joint Sealant Data Sheet at end of this Section, including those requirements referencing ASTM C 920 classifications for Type, Grade, Class, and Uses.

   1. Additional Movement Capability: Where additional movement capability is specified in Elastomeric Joint Sealant Data Sheet, provide products with the capability, when tested for adhesion and cohesion under maximum cyclic movement per ASTM C 719, to withstand the specified percentage change in the joint width existing at time of installation and remain in compliance with other requirements of ASTM C 920 for Uses indicated.

B. Products: Subject to compliance with requirements, provide one of the following products: DOW Silicone Sealant 795.

2.3 LATEX JOINT SEALANTS

A. General: Provide manufacturer's standard one-part, non-sag, mildew-resistant, paintable latex sealant of formulation indicated that is recommended for exposed applications on interior and protected exterior locations and that accommodates indicated percentage change in joint width existing at time of installation without failing either adhesively or cohesively.

B. Acrylic-Emulsion Sealant: Provide product complying with ASTM C 834 that accommodates joint movement of not more than 5 percent in both extension and compression for a total of 10 percent.

C. Silicone Emulsion Sealant: Provide product complying with ASTM C 834 and, except for weight loss measured per ASTM C 792, with ASTM C 920 that accommodates joint movement of not more than 25 percent in both extension and compression for a total of 50 percent.

D. Available Products: Subject to compliance with requirements, latex joint sealants that may be incorporated in the Work include, but are not limited to, the following:

E. Products: Subject to compliance with requirements, provide one of the following:
   1. Acrylic-Emulsion Sealant:
      c. "Tremco Acrylic Latex 834," Tremco, Inc.
   2. Silicone-Emulsion Sealant:
THERMAL AND MOSITURE PROTECTION
DIVISION 7

2.4 JOINT SEALANT BACKING

A. General: Provide sealant backings of material and type that are nonstaining; are compatible with joint substrates, sealants, primers and other joint fillers; and are approved for applications indicated by sealant manufacturer based on field experience and laboratory testing.

B. Plastic Foam Joint Fillers: Preformed, compressible, resilient, nonstaining, nonwaxing, nonextruding strips of flexible plastic foam of material indicated below and of size, shape, and density to control sealant depth and otherwise contribute to producing optimum sealant performance:
1. Open-cell polyurethane foam.
2. Closed-cell polyethylene foam, nonabsorbent to liquid water and gas, nonoutgassing in unruptured state.
3. Proprietary, reticulated, closed-cell polymeric foam, nonoutgassing, with a density of 2.5 pcf (40 kg/cu. m) and tensile strength of 35 psi (240 kPa) per ASTM D 1623, and with water absorption less than 0.02 g/cc per ASTM C 1083.
4. Any material indicated above.

C. Elastomeric Tubing Joint Fillers: Neoprene, butyl, EPDM, or silicone tubing complying with ASTM D 1056, nonabsorbent to water and gas, capable of remaining resilient at temperatures down to -26 deg F (-32 deg C). Provide products with low compression set and of size and shape to provide a secondary seal, to control sealant depth, and otherwise contribute to optimum sealant performance.

D. Bond-Breaker Tape: Polyethylene tape or other plastic tape as recommended by sealant manufacturer for preventing sealant from adhering to rigid, inflexible joint filler materials or joint surfaces at back of joint where such adhesion would result in sealant failure. Provide self-adhesive tape where applicable.

2.9 MISCELLANEOUS MATERIALS

A. Primer: Material recommended by joint sealant manufacturer where required for adhesion of sealant to joint substrates indicated, as determined from preconstruction joint sealant-substrate tests and field tests.

B. Cleaners for Nonporous Surfaces: Chemical cleaners acceptable to manufacturers of sealants and sealant backing materials, free of oily residues or other substances capable of staining or harming in any way joint substrates and adjacent nonporous surfaces, and formulated to promote optimum adhesion of sealants with joint substrates.

C. Masking Tape: Nonstaining, nonabsorbent material compatible with joint sealants and surfaces adjacent to joints.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine joints indicated to receive joint sealants, with Installer present, for compliance with
requirements for joint configuration, installation tolerances, and other conditions affecting joint sealant performance. Do not proceed with installation of joint sealants until unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Surface Cleaning of Joints: Clean out joints immediately before installing joint sealants to comply with recommendations of joint sealant manufacturer and the following requirements:
   1. Remove all foreign material from joint substrates that could interfere with adhesion of joint sealant, including dust, paints (except for permanent, protective coatings tested and approved for sealant adhesion and compatibility by sealant manufacturer), old joint sealants, oil, grease, waterproofing, water repellents, water, surface dirt, and frost.
   2. Clean concrete, masonry, unglazed surfaces of ceramic tile, and similar porous joint substrate surfaces by brushing, grinding, blast cleaning, mechanical abrading, or a combination of these methods to produce a clean, sound substrate capable of developing optimum bond with joint sealants. Remove loose particles remaining from above cleaning operations by vacuuming or blowing out joints with oil-free compressed air.
   3. Remove laitance and form release agents from concrete.
   4. Clean metal, glass, porcelain enamel, glazed surfaces of ceramic tile, and other nonporous surfaces with chemical cleaners or other means that do not stain, harm substrates, or leave residues capable of interfering with adhesion of joint sealants.

B. Joint Priming: Prime joint substrates where indicated or where recommended by joint sealant manufacturer based on preconstruction joint sealant-substrate tests or prior experience. Apply primer to comply with joint sealant manufacturer's recommendations. Confine primers to areas of joint sealant bond; do not allow spillage or migration onto adjoining surfaces.

C. Masking Tape: Use masking tape where required to prevent contact of sealant with adjoining surfaces that otherwise would be permanently stained or damaged by such contact or by cleaning methods required to remove sealant smears. Remove tape immediately after tooling without disturbing joint seal.

3.3 INSTALLATION OF JOINT SEALANTS

A. General: Comply with joint sealant manufacturer's printed installation instructions applicable to products and applications indicated, except where more stringent requirements apply.

B. Sealant Installation Standard: Comply with recommendations of ASTM C 1193 for use of joint sealants as applicable to materials, applications, and conditions indicated.

C. Installation of Sealant Backings: Install sealant backings to comply with the following requirements:
   1. Install joint fillers of type indicated to provide support of sealants during application and at position required to produce the cross-sectional shapes and depths of installed sealants relative to joint widths that allow optimum sealant movement capability.
      a. Do not leave gaps between ends of joint fillers.
      b. Do not stretch, twist, puncture, or tear joint fillers.
      c. Remove absorbent joint fillers that have become wet prior to sealant application and replace with dry material.
   2. Install bond breaker tape between sealants where backer rods are not used between sealants and joint fillers or back of joints.
D. Installation of Sealants: Install sealants by proven techniques that result in sealants directly contacting and fully wetting joint substrates, completely filling recesses provided for each joint configuration, and providing uniform, cross-sectional shapes and depths relative to joint widths that allow optimum sealant movement capability. Install sealants at the same time sealant backings are installed.

E. Tooling of Non-sag Sealants: Immediately after sealant application and prior to time skinning or curing begins, tool sealants to form smooth, uniform beads of configuration indicated, to eliminate air pockets, and to ensure contact and adhesion of sealant with sides of joint. Remove excess sealants from surfaces adjacent to joint. Do not use tooling agents that discolor sealants or adjacent surfaces or are not approved by sealant manufacturer.
1. Provide concave joint configuration per Figure 5A in ASTM C 1193, unless otherwise indicated.
2. Provide flush joint configuration, per Figure 5B in ASTM C 1193, where indicated.
3. Provide recessed joint configuration, per Figure 5C in ASTM C 1193, of recess depth and at locations indicated.
   a. Use masking tape to protect adjacent surfaces of recessed tooled joints.

3.4 CLEANING

A. Clean off excess sealants or sealant smears adjacent to joints as work progresses by methods and with cleaning materials approved by manufacturers of joint sealants and of products in which joints occur.

3.5 PROTECTION

A. Protect joint sealants during and after curing period from contact with contaminating substances or from damage resulting from construction operations or other causes so that they are without deterioration or damage at time of Substantial Completion. If, despite such protection, damage or deterioration occurs, cut out and remove damaged or deteriorated joint sealants immediately so that and installations with repaired areas are indistinguishable from original work.
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 steel doors and frames.

B. Related Sections: The following Sections contain requirements that relate to this Section:
   1. Section 04200 - Unit Masonry Assemblies: for building anchors into and grouting frames in masonry construction.
   2. Section 08211 - Flush Wood Doors: for hollow-core and solid-core wood doors installed in steel frames.
   3. Section 08710 - Door Hardware: for door hardware and weather stripping.
   4. Section 08800 - Glazing: for glass in steel doors and sidelights.
   5. Section 09250 - Gypsum Board: for spot grouting frames in gypsum board partitions.
   6. Section 09900 - Painting: for field painting primed doors and frames.

1.3 SUBMITTALS

A. General: Submit each item in this Article according to the Conditions of the Contract and Division 1 Specification Sections.

B. Product Data for each type of door and frame specified, including details of construction, materials, dimensions, hardware preparation, core, label compliance, sound ratings, profiles, and finishes.

C. Shop Drawings showing fabrication and installation of steel doors and frames. Include details of each frame type, elevations of door design types, conditions at openings, details of construction, location and installation requirements of door and frame hardware and reinforcements, and details of joints and connections. Show anchorage and accessory items.

D. Door Schedule: Submit schedule of doors and frames using same reference numbers for details and openings as those on Contract Drawings.
   1. Indicate coordination of glazing frames and stops with glass and glazing requirements.

1.4 QUALITY ASSURANCE

A. Provide doors and frames complying with ANSI/SDI 100 “Recommended Specifications for Standard Steel Doors and Frames” and as specified.

B. Fire-Rated Door Assemblies: Units that comply with NFPA 80, are identical to door and frame assemblies tested for fire-test-response characteristics per ASTM E 152, and are labeled and listed by UL, Warnock Hersey, or another testing and inspecting agency acceptable to authorities having jurisdiction.
   1. Temperature-Rise Rating: Where indicated, provide doors that have a temperature-rise rating of 450 deg F (250 deg C) maximum in 30 minutes of fire exposure.
1.5 **DELIERY, STORAGE, AND HANDLING**

A. Deliver doors and frames cardboard-wrapped or crated to provide protection during transit and job storage. Provide additional protection to prevent damage to finish of factory-finished doors and frames.

B. Inspect doors and frames on delivery for damage. Minor damages may be repaired provided refinished items match new work and are acceptable to Architect; otherwise, remove and replace damaged items as directed.

C. Store doors and frames at building site under cover. Place units on minimum 4-inch-(100-mm-) high wood blocking. Avoid using nonvented plastic or canvas shelters that could create a humidity chamber. If cardboard wrappers on doors become wet, remove cartons immediately. Provide minimum 1/4-inch (6-mm) spaces between stacked doors to promote air circulation.

**PART 2 - PRODUCTS**

2.1 **MANUFACTURERS**

A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated in the Work include, but are not limited to, the following:

B. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Steel Doors and Frames:
   a. Ceco Door Products.
   b. Curries Co.
   c. Steelcraft.
   d. D & D
   e. Fleming
   f. Haberaham
   g. Republic Builders Products

2.2 **MATERIALS**

A. Hot-Rolled Steel Sheets and Strip: Commercial-quality carbon steel, pickled and oiled, complying with ASTM A 569 (ASTM A 569M).

B. Cold-Rolled Steel Sheets: Carbon steel complying with ASTM A 366 (ASTM A 366M), commercial quality, or ASTM A 620 (ASTM A 620M), drawing quality, special killed.

C. Galvanized Steel Sheets: Zinc-coated carbon steel complying with ASTM A 526 (ASTM A 526M), commercial quality, or ASTM A 642 (ASTM A 642M), drawing quality, hot-dip galvanized according to ASTM A 525, with A 60 or G 60 (ASTM A 525M, with Z 180 or ZF 180) coating designation, mill phosphatized.

D. Supports and Anchors: Fabricated from not less than 0.0478-inch-(1.2-mm-) thick steel sheet; 0.0516-inch-(1.3-mm-) thick galvanized steel where used with galvanized steel frames.

E. Inserts, Bolts, and Fasteners: Manufacturer's standard units. Where items are to be built into
exterior walls, hot-dip galvanize complying with ASTM A 153, Class C or D as applicable.

2.3  DOORS

A. Steel Doors: Provide 1-3/4-inch- (44-mm-) thick doors of materials and ANSI/SDI 100 grades and models specified below, or as indicated on Drawings or schedules:
1. Interior Doors: Grade II, heavy-duty, Model 2, seamless design, minimum 0.0478-inch- (1.2-mm-) thick cold-rolled steel sheet faces.
2. Exterior Doors: Grade II, heavy-duty, Model 2, seamless design, minimum 0.0516-inch- (1.3-mm-) thick galvanized steel sheet faces.

B. Door Louvers: Provide louvers according to SDI 111C for interior doors where indicated, with blades or baffles formed of 0.0239-inch- (0.6-mm-) thick cold-rolled steel sheet set into minimum 0.0359-inch- (0.9-mm-) thick steel frame.
1. Sight-Proof Louvers: Stationary louvers constructed with inverted V-shaped or Y-shaped blades.

2.4  FRAMES

A. Provide metal frames for doors, transoms, sidelights, borrowed lights, and other openings, according to ANSI/SDI 100, and of types and styles as shown on Drawings and schedules. Conceal fastenings, unless otherwise indicated. Fabricate frames as follows:
1. Fabricate frames with mitered or coped and continuously welded corners.
2. Fabricate frames for interior openings of 16 Gage steel sheet.
3. Form exterior frames from 14 Gage galvanized steel sheet.

B. Door Silencers: Except on weather stripped frames, drill stops to receive 3 silencers on strike jambs of single-door frames and 2 silencers on heads of double-door frames.

C. Plaster Guards: Provide minimum 0.0179-inch- (0.45-mm-) thick steel plaster guards or mortar boxes at back of hardware cutouts where mortar or other materials might obstruct hardware operation and to close off interior of openings.

D. Grout: When required in masonry construction, as specified in Division 4 Section "Unit Masonry Assemblies."

2.5  FABRICATION

A. Fabricate steel door and frame units to be rigid, neat in appearance, and free from defects, warp, or buckle. Where practical, fit and assemble units in manufacturer's plant. Clearly identify work that cannot be permanently factory assembled before shipment, to assure proper assembly at Project site. Comply with ANSI/SDI 100 requirements.

1. Internal Construction: One of the following manufacturer's standard core materials according to SDI standards:
   a. Unitized steel grid.
   b. Vertical steel stiffeners.
   c. Rigid mineral fiber with internal sound deadener on inside of face sheets.

2. Clearances: Not more than 1/8 inch (3.2 mm) at jambs and heads, except not more than 1/4 inch (6.4 mm) between non-fire-rated pairs of doors. Not more than 3/4 inch (19 mm) at bottom.
a. Fire Doors: Provide clearances according to NFPA 80.

B. Fabricate exposed faces of doors and panels, including stiles and rails of nonflush units, from only cold-rolled steel sheet.

C. Tolerances: Comply with SDI 117 "Manufacturing Tolerances Standard Steel Doors and Frames."

D. Fabricate concealed stiffeners, reinforcement, edge channels, louvers, and moldings from either cold- or hot-rolled steel sheet.

E. Galvanized Steel Doors, Panels, and Frames: For the following locations, fabricate doors, panels, and frames from galvanized steel sheet according to SDI 112. Close top and bottom edges of doors flush as an integral part of door construction or by addition of minimum 0.0635-inch- (1.6-mm-) thick galvanized steel channels, with channel webs placed even with top and bottom edges. Seal joints in top edges of doors against water penetration.
   1. At exterior locations.

F. Exposed Fasteners: Unless otherwise indicated, provide countersunk flat or oval heads for exposed screws and bolts.

G. Thermal-Rated (Insulating) Assemblies: At exterior locations and elsewhere as shown or scheduled, provide doors fabricated as thermal-insulating door and frame assemblies and tested according to ASTM C 236 or ASTM C 976 on fully operable door assemblies.
   1. Unless otherwise indicated, provide thermal-rated assemblies with U-value rating of 0.41 Btu/sq. ft. x h x deg F (2.33 W/sq. m x K) or better.

H. Hardware Preparation: Prepare doors and frames to receive mortised and concealed hardware according to final door hardware schedule and templates provided by hardware supplier. Comply with applicable requirements of SDI 107 and ANSI A115 Series specifications for door and frame preparation for hardware.
   1. For concealed overhead door closers, provide space, cutouts, reinforcing, and provisions for fastening in top rail of doors or head of frames, as applicable.

I. Reinforce doors and frames to receive surface-applied hardware. Drilling and tapping for surface-applied hardware may be done at Project site.

J. Locate hardware as indicated on Shop Drawings or, if not indicated, according to the Door and Hardware Institute's (DHI) "Recommended Locations for Architectural Hardware for Standard Steel Doors and Frames."

K. Glazing Stops: Minimum 0.0359-inch- (0.9-mm-) thick steel or 0.040-inch- (1-mm-) thick aluminum.
   1. Provide non-removable stops on outside of exterior doors and on secure side of interior doors for glass, louvers, and other panels in doors.
   2. Provide screw-applied, removable, glazing beads on inside of glass, louvers, and other panels in doors.

2.6 FINISHES, GENERAL

A. Comply with NAAMM's "Metal Finishes Manual" for recommendations relative to applying and designating finishes.
C. Apply primers and organic finishes to doors and frames after fabrication.

### 2.7 GALVANIZED STEEL SHEET FINISHES

**A. Surface Preparation:** Clean surfaces with nonpetroleum solvent so that surfaces are free of oil or other contaminants. After cleaning, apply a conversion coating of the type suited to the organic coating applied over it. Clean welds, mechanical connections, and abraded areas, and apply galvanizing repair paint specified below to comply with ASTM A 780.

1. **Galvanizing Repair Paint:** High-zinc-dust-content paint for re-galvanizing welds in galvanized steel, with dry film containing not less than 94 percent zinc dust by weight, and complying with DOD-P-21035 or SSPC-Paint 20.

**B. Factory Priming for Field-Painted Finish:** Where field painting after installation is indicated, apply air-dried primer specified below immediately after cleaning and pretreatment.

1. **Shop Primer:** Zinc-dust, zinc-oxide primer paint complying with performance requirements of FS TT-P-641, Type II.

### 2.8 STEEL SHEET FINISHES

**A. Surface Preparation:** Solvent-clean surfaces to comply with SSPC-SP 1 to remove dirt, oil, grease, and other contaminants that could impair paint bond. Remove mill scale and rust, if present, from uncoated steel to comply with SSPC-SP 5 (White Metal Blast Cleaning) or SSPC-SP 8 (Pickling).

**B. Pretreatment:** Immediately after surface preparation, apply a conversion coating of type suited to organic coating applied over it.

**C. Factory Priming for Field-Painted Finish:** Apply shop primer that complies with ANSI A224.1 acceptance criteria, is compatible with finish paint systems indicated, and has capability to provide a sound foundation for field-applied topcoats. Apply primer immediately after surface preparation and pretreatment.

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**PART 3 - EXECUTION**

### 3.1 INSTALLATION

**A. General:** Install steel doors, frames, and accessories according to Shop Drawings, manufacturer's data, and as specified.

**B. Placing Frames:** Comply with provisions of SDI 105, unless otherwise indicated. Set frames accurately in position, plumbed, aligned, and braced securely until permanent anchors are set. After wall construction is completed, remove temporary braces and spreaders, leaving surfaces smooth and undamaged.

1. In masonry construction, install at least 3 wall anchors per jamb adjacent to hinge location on hinge jamb and at corresponding heights on strike jamb. Acceptable anchors include masonry wire anchors and masonry T-shaped anchors.
2. Install fire-rated frames according to NFPA 80.
C. Door Installation: Fit hollow-metal doors accurately in frames, within clearances specified in ANSI/SDI 100.
   1. Fire-Rated Doors: Install with clearances specified in NFPA 80.

3.2 ADJUSTING AND CLEANING

A. Prime Coat Touchup: Immediately after erection, sand smooth any rusted or damaged areas of prime coat and apply touchup of compatible air-drying primer.

B. Protection Removal: Immediately before final inspection, remove protective wrappings from doors and frames.

END OF SECTION
PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This Section includes the following:
   1. Solid core doors with wood veneer faces.
   2. Factory finishing of flush wood doors.

B. Related Sections: The following Sections contain requirements that relate to this Section:
   1. Division 6 Section "Finish Carpentry" for wood door frames.

1.3 SUBMITTALS

A. General: Submit each item in this Article according to the Conditions of the Contract and Division 1 Specification Sections.

B. Product data for each type of door, including details of core and edge construction, trim for openings and louvers, and factory-finishing specifications.

C. Shop drawings indicating location and size of each door, elevation of each kind of door, details of construction, location and extent of hardware blocking, fire ratings, requirements for veneer matching and factory finishing and other pertinent data.
   1. For factory-machined doors, indicate dimensions and locations of cutouts for locksets and other cutouts adjacent to light and louver openings.

D. Samples for initial selection in the form of color charts consisting of actual materials in small sections for the following:
   1. Faces of factory-finished doors with transparent finish. Show the full range of colors available for stained finishes.
   2. Faces of factory-finished doors with opaque finish. Show the full range of colors available.

E. Samples for verification in the form and size indicated below:
   1. Corner sections of doors approximately 12 inches (300 mm) square with door faces and edgings representing the typical range of color and grain for each species of veneer and solid lumber required. Finish sample with same materials proposed for factory-finished doors.

1.4 QUALITY ASSURANCE

A. Quality Standard: Comply with the following standard:
   2. AWI Quality Standard: "Architectural Woodwork Quality Standards" of the Architectural Woodwork Institute for grade of door, core, construction, finish, and other requirements.
a. Provide WIC Certified Compliance Certificate indicating that doors meet requirements of grades specified.
b. Provide WIC Certified Compliance Certificate for installation.

B. Fire-Rated Wood Doors: Provide wood doors that comply with NFPA 80; are identical in materials and construction to units tested in door and frame assemblies per ASTM E 152; and are labeled and listed by UL, Warnock Hersey, or another testing and inspection agency acceptable to authorities having jurisdiction.

C. Single-Source Responsibility: Obtain doors from one source and by a single manufacturer.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Protect doors during transit, storage, and handling to prevent damage, soiling, and deterioration. Comply with requirements of referenced standard and manufacturer's instructions.

B. Identify each door with individual opening numbers as designated on shop drawings, using temporary, removable, or concealed markings.

1.6 PROJECT CONDITIONS

A. Conditioning: Do not deliver or install doors until building is enclosed, wet work is complete, and HVAC system is operating and will maintain temperature and relative humidity at occupancy levels during the remainder of the construction period.

1.7 WARRANTY

A. General Warranty: Door manufacturer's warranty specified in this Article shall not deprive the Owner of other rights the Owner may have under other provisions of the Contract Documents and shall be in addition to, and run concurrent with, other warranties made by the Contractor under requirements of the Contract Documents.

B. Door Manufacturer's Warranty: Submit written agreement on door manufacturer's standard form signed by manufacturer, Installer, and Contractor, agreeing to repair or replace defective doors that have warped (bow, cup, or twist) more than 1/4 inch (6.35 mm) in a 42-by-84-inch (1067-by-2134-mm) section or that show telegraphing of core construction in face veneers exceeding 0.01 inch in a 3-inch (0.25 mm in a 75-mm) span, or do not conform to tolerance limitations of referenced quality standards.
1. Warranty shall also include installation and finishing that may be required due to repair or replacement of defective doors where defect was not apparent prior to hanging.
2. Warranty shall be in effect during the following period of time after date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering doors
that may be incorporated in the Work include, but are not limited to, the following:

B. Manufacturer: Subject to compliance with requirements, provide doors by one of the following:
   1. Solid Core Doors:
      a. Algoma Hardwoods Inc.
      b. Buell Door Co.
      c. Eggers Industries, Architectural Door Division.
      d. Fenestra Corporation.
      e. Mohawk Flush Doors, Inc.
      f. Weyerhauser Co.
      g. Chappell Door

2.2 INTERIOR Flush WOOD DOORS

A. Solid Core Doors for Transparent Finish: Comply with the following requirements:
   1. Faces: White birch, plain sliced.
   2. Grade: Premium.
   3. Construction: 5 plies.
   5. Core: Non-glued-block core.
   6. Bonding: Stiles and rails bonded to core, then entire unit abrasive planed before veneering.

B. Fire-Rated Solid Core Doors: Comply with the following requirements:
   1. Faces and Grade: Provide faces and grade to match non-fire-rated doors in same area of building, unless otherwise indicated.
   2. Construction: Manufacturer's standard core construction as required to provide fire-resistance rating indicated.
   3. Blocking: Provide composite blocking designed to maintain fire resistance of door butt with improved screw-holding capability of same thickness as core and with minimum dimensions as follows:
      a. 5-inch (125-mm) top rail blocking.
      b. 5-inch (125-mm) bottom rail blocking.
      c. 5-by-18-inch (125-by-450-mm) lock blocks.
      d. 5-inch (125-mm) midrail blocking.
   4. Edge Construction: Provide manufacturer's standard laminated-edge construction for improved screw-holding capability and split resistance as compared to edges composed of a single layer of treated lumber.

2.3 FABRICATION

A. Fabricate flush wood doors to comply with following requirements:
   1. In sizes indicated for job-site fitting.
   2. Factory fit doors to suit frame-opening sizes indicated, with the following uniform clearances and bevels:
      a. Comply with clearance requirements of referenced quality standard for fitting.
      b. Comply with requirements of NFPA 80 for fire-resistance-rated doors.
   3. Factory machine doors for hardware that is not surface applied. Locate hardware to comply with DHI-WDHS-3. Comply with final hardware schedules, door frame shop drawings, DHI A115-W series standards, and hardware templates.
      a. Coordinate measurements of hardware mortises in metal frames to verify dimensions and alignment before proceeding with factory machining.
b. Metal Astragals: Premachine astragals and formed-steel edges for hardware for pairs of fire-rated doors.

B. Openings: Cut and trim openings through doors to comply with applicable requirements of referenced standards for kind(s) of door(s) required.
   1. Light Openings: Trim openings with moldings of material and profile indicated.
   2. Louvers: Factory install louvers in prepared openings.

2.4 FACTORY FINISHING

A. General: Comply with referenced quality standard's requirements for factory finishing.

B. Finish wood doors at factory.

C. Transparent Finish: Comply with requirements indicated for grade, finish system, staining effect, and sheen.
   1. Grade: Premium.
   2. Finish: AWI System TR-6 catalyzed polyurethane.
   5. Stain: Color to be selected by Architect

PART 3-EXECUTION

3.1 EXAMINATION

A. Examine installed door frames prior to hanging door:
   1. Verify that frames comply with indicated requirements for type, size, location, and swing characteristics and have been installed with plumb jambs and level heads.
   2. Reject doors with defects.

B. Do not proceed with installation until unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Hardware: For installation see Division 8 Section "Door Hardware."

B. Manufacturer's Instructions: Install wood doors to comply with manufacturer's instructions and referenced quality standard and as indicated.
   1. Install fire-rated doors in corresponding fire-rated frames according to requirements of NFPA 80.

C. Job-Fit Doors: Align and fit doors in frames with uniform clearances and bevels as indicated below; do not trim stiles and rails in excess of limits set by manufacturer or permitted with fire-rated doors. Machine doors for hardware. Seal cut surfaces after fitting and machining.
   1. Fitting Clearances for Non-Fire-Rated Doors: Provide 1/8 inch (3.2 mm) at jambs and heads, 1/16 inch (1.6 mm) per leaf at meeting stiles for pairs of doors, and 1/8 inch (3.2 mm) from bottom of door to top of decorative floor finish or covering. Where threshold is shown or scheduled, provide 1/4-inch (6.4-mm) clearance from bottom of door to top of threshold.
2. Fitting Clearances for Fire-Rated Doors: Comply with NFPA 80.
3. Bevel non-fire-rated doors 1/8 inch in 2 inches (3-1/2 degrees) at lock and hinge edges.
4. Bevel fire-rated doors 1/8 inch in 2 inches (3-1/2 degrees) on lock edge; trim stiles and rails only to extent permitted by labeling agency.

D. Factory-Fitted Doors: Align in frames for uniform clearance at each edge.
E. Factory-Finished Doors: Restore finish before installation, if fitting or machining is required at the job site.

3.3 ADJUSTING AND PROTECTION

A. Operation: Rehang or replace doors that do not swing or operate freely.
B. Finished Doors: Refinish or replace doors damaged during installation.
C. Protect doors as recommended by door manufacturer to ensure that wood doors will be without damage or deterioration at the time of Substantial Completion.

END OF SECTION
PART 1 GENERAL

1.1 RELATED DOCUMENTS
A. Drawings and general provisions of the Contract, including General and Special Conditions apply to this Section.

1.2 SUMMARY
A. This section includes, but is not limited to:
   B. Access door and frame units.

1.3 RELATED SECTIONS
A. Section 09900 - Painting and Coating: Field paint finish.

1.4 REFERENCES

1.5 SUBMITTALS
A. Product Data: Provide sizes, types, finishes, hardware, scheduled locations, and details of adjoining work.
B. Shop Drawings: Indicate exact position of all access door units.
C. Samples: Submit two access units, 12 x 12 inch (305 x 305 mm) in size illustrating hardware, frame configuration, anchors, and door configuration.
D. Manufacturer's Installation Instructions: Indicate installation requirements.
E. Project Record Documents: Record actual locations of all access units.

PART 2 PRODUCTS

2.1 ACCESS DOORS AND PANELS
A. All Units: Factory fabricated, fully assembled units with corner joints welded, filled, and ground flush; square and without rack or warp; coordinate requirements with assemblies units are to be installed in.

2.2 WALL UNITS
A. Door and Frame Units: Formed steel.
1. Frames and flanges: 0.058 inch (1.5 mm) steel.

2. Door panels: 0.070 inch (1.8 mm) single thickness steel sheet.

3. Sizes:
   a. Walls: 12 x 12 inches (300 x 300 mm), unless noted otherwise.

4. Hardware:
   a. Hinge: 175 degree stainless steel piano hinge with removable pin.
   b. Lock: Screw driver slot for quarter turn cam lock.

5. Galvanized, hot dipped finish.

2.3 FABRICATION
A. Weld, fill, and grind joints to ensure flush and square unit.

PART 3 EXECUTION

3.1 EXAMINATION
A. Verify that rough openings are correctly sized and located.

3.2 INSTALLATION
A. Install units in accordance with manufacturer's instructions.
B. Install frames plumb and level in openings. Secure rigidly in place.
C. Position units to provide convenient access to the concealed work requiring access.

END OF SECTION
PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Exterior swinging Four-Fold metal doors with surface mounted tube frames.
   2. Operation of Four-Fold metal doors includes overhead mounted electro-mechanical operator(s) located on the interior side of the wall.

1.2 SUBMITTALS

A. General: Submit each item in this Article according to the Conditions of the Contract and Division 1 Specification Sections.

B. Product Data for each type of product specified consisting of manufacturer’s technical Product Data and installation instructions for each type of door required, including data substantiating that products comply with requirements.

C. Submittal Drawings showing fabrication and installation of Four-Fold metal doors including plans, elevations, sections, details of components, hardware, operating mechanism, and attachments to the other units of Work. Include wiring diagrams for coordination with electrical trade.

D. Reference list including (5) successful installations of this type of door within the past two (2) years.

1.3 SUBMITTALS

A. Doors shall be designed to withstand external or internal horizontal wind loads of 20 pounds minimum per square foot. The maximum allowable deflection shall not exceed 1/120 of the span. Fiber stresses in main members shall be limited to 27,000 pounds per square inch. Steel frames shall be designed in accordance with the AISC “Steel Construction Manual.

B. Door manufacturer shall have at least 10 years experience in manufacturing door type specified for emergency vehicle applications.

1.4 DELIVERY, STORAGE AND HANDLING

A. Transport, handle, store, and protect products in compliance with the requirements of Sections 01600 and manufacturer’s recommendations.
   1. Store delivered materials and equipment in dry locations with adequate ventilation, free from dust and water, and so as to permit access for inspection and handling.
   2. Handle materials carefully to prevent damage.

1.5 WARRANTY

A. The door manufacturer shall provide a written standard limited warranty for material and workmanship.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers: Four-Fold industrial metal doors manufactured by Door Engineering and Manufacturing, 400 Cherry Street, Kasota, MN 56050, (800)-959-1352 or equal products by other manufacturers approved in advance
2.2 MATERIALS

A. Steel Tube: ASTM A513 and ASTM A500/A500M

B. Steel Sheet: Steel sheets of commercial quality, complying with ASTM A1011/A1011M hot rolled steel sheet.

C. Hardware: Manufacturer’s standard components.

D. Fasteners: Zinc-coated steel.

2.3 FOUR-FOLD DOORS

A. Construction: Door framing shall be minimum 11-gauge structural steel tube with 14-gauge steel sheet on the exterior and interior faces. Sheeting shall be formed on the vertical edges with no visible welds on the interior or exterior panel faces. All frames and framing members shall be true to dimension and square in all directions, and no door shall be bowed, warped, or out of line, in the vertical or horizontal plane of the door opening by more than 1/8 inch in 20 feet. Exposed welds and welds which interfere with the installation of various parts shall be ground smooth and flush.

B. Angle Frame: Supply pre-hung tube frame system constructed of minimum L6x4x0.25, designed to anchor to masonry wall construction or weld to steel structure. All hinges, track supports and operator supports shall be factory attached.

C. Factory finish: Operator and operating hardware shall be powder coated manufacturer’s standard gray. Panels, frame and all other hardware shall be finished as follows.

All exposed steel shall be finished with manufacturer’s standard epoxy primer and polyurethane top coat, PPG Spectracron or equal. Customer to select from Manufacturer’s standard color chart or furnish color to match.

D. Operating Hardware: Hardware shall include guide tracks and brackets, trolleys, center guides, not less than three pairs of jamb and fold hinges per opening, and all bolts, nuts, fasteners, etc. necessary for complete installation and operation. Jamb hinges shall be dual shear and have two thrust bearings and two needle bearings. Jamb hinges shall be gusseted. Fold hinges shall be dual shear with two thrust bearings. Fold hinges shall be stainless steel. All bearings shall be completely concealed within the hinge barrel and include grease zerks. All hinge pins shall be minimum ¾” diameter hardened steel.

E. Weatherstripping: Material shall be adjustable and readily replaceable and provide a substantially weather-tight installation. Weatherstripping at center shall be 1/16” cloth inserted neoprene and include no exposed fasteners on the exterior face of the panel. Weatherstripping at sill shall include two 1/16” cloth inserted neoprene sweeps with an aluminum retainer. The retainer shall be attached to the door with adhesive.

F. Perimeter Weatherstripping: Provide jamb and head weatherstripping of 1/16” cloth-inserted neoprene bulb (or closed cell neoprene).

G. Vision Panels: Provide 1” insulated vision panels or grilles of the size, shape and location as noted on the drawings.

2.4 OPERATOR
DOOR AND WINDOWS

EXTERIOR SWINGING FOUR-FOLD DOOR SYSTEMS

DIVISION 8

SECTION 08365

A. Each Four-Fold door shall be operated by an overhead mounted electro-mechanical drive unit designed for high cycle operation. Each Operator consists of an electric motor, gear reducer, and rotating drive arm. The door shall be operated with connecting rods attached to the rotating drive arm on the operator and to control arms attached to the jamb door section and to the door lintel. The connecting rods shall be positive drive, keeping the door under firm control at all times. The connecting rods shall be fitted with spherical bearings and control arms shall be equipped with oil impregnated bronze bearings on polished shafts.

B. Operator shall be instantly reversible, open and close rapidly and start and stop gradually. Operator shall be adjustable to allow door to fully clear the opening. Operator shall automatically lock the door in the closed position. Operator shall be equipped with disengaging mechanism to convert to free wheeling mode for manual operation.

C. Electric motor shall be of sufficient size to operate doors under normal operating conditions at no more than 75 percent of rated capacity. The motor shall be wound for three phase 208/230/480 VAC, 60 Hertz operation.

D. Electric Controls: Controls shall be furnished by the door manufacturer and shall be complete for each door, and built in accordance with the latest NEMA standards. Incoming electrical shall be: 208/230VAC 3-phase.
   1. Controls Controls shall include a programmable logic controller with digital message display or LED indicators. Controller shall include programmable close timers and programmable inputs/outputs.
   2. Motor starters shall be magnetic reversing, factory wired with overload and under voltage protection, and equipped with mechanical interlocks. All control components shall be enclosed in one enclosure with a wiring diagram placed on the inside of the cover.
   3. If incoming voltage is single phase, control panel shall include a variable frequency drive to convert voltage to 3-phase for the motor.
   4. Enclosures shall be NEMA 4 with disconnect switch.
   5. Pushbuttons (interior) for each door shall have one (1) momentary pressure three-button push-button station marked “OPEN”, “CLOSE” and “STOP”. Push button enclosure shall be NEMA 4.
   6. Limit switches shall be provided to stop the travel of the door in its fully open or fully closed position.
   7. Safety edges: Provide electric safety edges on leading edge of all doors to reverse door upon contact with obstruction.
   8. Photo eyes: Provide (1) interior, jamb mounted, thru-beam type photo eyes, NEMA 4 rated.
  10. Radio controls: Provide one (1) radio receiver and (1) single button remotes per door. Remotes to open and close doors with single button.
  11. Timer Activation Loop Detectors (fire station applications): Provide “pulse on exit type” loop detector to activate auto close timer once loop has been activated and cleared, include hand/auto switch to deactivate timer. G.C. to coordinate installation of preformed loop with installer prior to exterior apron being poured.
  12. Wiring: Door manufacturer shall supply controls and components only. Electrical contractor shall install controls and furnish and install conduits and wiring for jobsite power and control wiring.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install Four-Fold metal doors in strict accordance with the approved drawings by qualified door erection crews. All door openings shall be completely prepared by the general contractor prior to the installation of the doors. Permanent or temporary electric wiring shall be brought to the door opening before installation is started and shall be completed so as not to delay the inspection test.
B. Doors shall be set plumb, level, and square, and with all parts properly fastened and mounted. All moving parts shall be tested and adjusted and left in good operating condition.

3.2 ADJUSTING AND CLEANING

A. Inspection of the doors and a complete operating test will be made by the installer in the presence of the general contractor or architect as soon as the erection is complete. Any defects noted shall be corrected. After door approval in the above test, the general contractor must assume the responsibility for any damage or rough handling of the doors during construction until the building is turned over to the owner and final inspection is made.

B. Clean surfaces and repaint abraded or damaged finished surfaces to match factory-applied finish.

END OF SECTION
PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
1. Aluminum doors, frames, and glazed lights.
2. Door hardware.
3. Aluminum glazed lights.

B. Related Sections:
1. Section 08710 - Finish Hardware: Coordinate cylinders, thresholds and other hardware.
2. Section 08800 - Glazing: Glass products.

1.2 REFERENCES

A. The publications listed below form a part of this specification to the extent referenced. Publications are referenced within the text by the basic designation only.

B. American Architectural Manufacturers Association (AAMA)
1. AAMA 611 - Voluntary Specifications for Anodized Architectural Aluminum.

C. ASTM International (ASTM):
1. ASTM A 123 - Zinc (Hot-Dip Galvanized) Coatings On Iron And Steel Products
2. ASTM E 283 - Standard Test Method For Determining Rate Of Air Leakage Through Exterior Windows, Curtain Walls, And Doors Under Specified Pressure Differences Across The Specimen
3. ASTM E 331 - Water Penetration Of Exterior Windows, Skylights, Doors, And Curtain Walls By Uniform Static Air Pressure Difference.


E. American National Standards Institute (ANSI):

1.3 SYSTEMS DESCRIPTION

A. Storefront System Performance Requirements:
1. Air Infiltration: ASTM E 283. Air infiltration rate shall not exceed 0.06 cfm/ft² at a static air pressure differential of 6.24 psf.
2. Water Penetration Under Static Pressure: Systems do not evidence water penetration through fixed glazing and framing areas when tested according to ASTM E 331 at a minimum static-air-pressure difference of 20 percent of positive wind-load design pressure, but not less than 6.24 lbs/sq. ft.
3. Structural Performance: Maximum deflection of L/175 of span under a windload pressure calculation by the manufacturer based on the design wind loads shown on the Structural Drawings but not less than 20 psf.

1.4 QUALITY ASSURANCE

A. Regulatory Requirements: Conform to disabled access requirements of the following:
1. State or Local requirements (where applicable).
2. ANSI A117.1.
3. ADA (Americans with Disabilities Act - 1990) requirements for entrance door access, entrance doors and hardware.
PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Subject to compliance with requirements, products by one of the following manufacturers may be provided.
   1. Kawneer Company, Inc., Contacts as follows:
      a. Central Area: Franklin, IN, (877) 505-3757, FAX: (800) 755-4639.
      b. Eastern Area: Bloomsburg, PA, (877) 505-3756, FAX: (800) 786-4097.
      c. Southern Area: Springdale AR, (877) 505-3783, FAX: (800) 800-4789.
      d. Western Area: Visalia, CA, (877) 505-3785, FAX: (800) 759-2810.
   2. EFCO Corporation; Monett, MO; (800) 221-4169.
   4. Tubelite, Inc.; Reed City, MI; (800) 866-2227.
   5. U.S. Aluminum Corporation; Waxahachie, TX; (800) 627-6440.
   6. Vistawall Architectural Products; Terrell, TX; (800) 869-4567.

B. Substitutions: Not permitted.

2.2 FRAMING

A. Interior Framing System: TRIFAB VG 451T, by Kawneer. 2 x 4-1/2 inch nominal dimension, thermally broken extruded aluminum flush glazed framing system
   1. Thermal Barrier: Thermal break with a 1/4" separation consisting of a two part chemically curing, high density polyurethane which is mechanically and adhesively joined to aluminum storefront sections.

B. Exterior Framing System: TRIFAB VG 451, by Kawneer. 2 x 4-1/2 inch nominal dimension, extruded aluminum flush glazed framing system.

C. Receptor Channel: Model No. 451VG570 and 451VG572, by Kawneer
   1. Finish: To match adjacent storefront system.

D. Member Wall Thickness: Each framing member shall provide structural strength to meet specified performance requirements.

2.3 DOORS

A. Doors: Series 350 swing door, medium stile, by Kawneer. Door sizes indicated on Drawings.
   1. Top Rail: 6-1/2 inch, single piece.
   2. Bottom Rail: 10 inch.
   3. Glazing: 1/4 inch thick units per Section 08800, with standard bevel glass stops.

2.4 HARDWARE

A. Closers:
   1. Single Acting Doors: Heavy duty, parallel arm only, surface closer meeting ADA-90 requirements, independently hung, with adjustable back check and 100 degree hold-open; slim line half covers, spray painted aluminum to match aluminum storefront system. Attachment: Thru-bolted in door. No drop-plates allowed.
      a. Dorma 7601PA Series.
      b. LCN P1461.
      c. Norton 8301BF.
      d. Russwin 2820DA.
      e. Yale 3301BF.
B. Pivots:
1. Off-set Pivots: For single acting doors.
2. Intermediate Pivots: For single acting doors, adjustable, load bearing, surface applied; to match door finish.


D. Hinges: Continuous aluminum geared hinge, concealed leaf, heavy duty, finish to match door finish. Roton Model 780-112HD as manufactured by Hager or equivalent.

E. Door Holder (Exterior doors only): 1221-4 cast iron, finish to match door color, by Trimco - Triangle Brass Mfg. Co.

F. Weatherstripping (Exterior doors only):
1. Head and Jamb: Replaceable wool, polypropylene, or nylon wool pile with aluminum strip backing, recessed in frame.
2. Sill: Semi-rigid polymeric material on aluminum anodized to match door; EPDM sweep strip; 38-560 by Kawneer or similar by other named manufacturers.

G. Threshold: See Section 08710.

H. Hardware Schedule: Provide hardware as scheduled for each exterior entry/exit doors as required under this Section. Coordinate with hardware supplier and prepare door for field installation as required for additional hardware as specified in Section 08710.
1. Off-set pivot hinges, top and bottom
2. Intermediate Pivots
3. Closers
4. Weatherstripping
5. Threshold, coordinate with Section 08710
6. Push / Pull Sets
7. Deadbolt Locks, coordinate cylinder with Section 08710.

I. Additional Hardware: Coordinate with hardware supplier and prepare door as required for additional field installed hardware as specified in Section 08710.

2.5 FABRICATION

A. Fabricate components with minimum clearances and shim spacing around perimeter of assembly, yet enabling installation and dynamic movement of perimeter seal.

B. Rigidly fit and secure joints and corners. Make joints and connections flush, hairline, and weatherproof.

C. Develop drainage holes with moisture pattern to exterior.

D. Prepare components to receive anchor devices. Fabricate anchorage items. Arrange fasteners, attachments, and jointing to ensure concealment from view.

E. Prepare components with internal reinforcement for door hardware.

F. Reinforce framing members for imposed loads.

G. Accessories:
1. Break Metal Closures: Minimum 0.040 inch thick aluminum x length required. Finish shall match adjacent related work.
2. Provide clean sharp edges, uniform in appearance and consistent in shape. Secure in place with concealed fasteners where possible. Exposed fasteners shall match enclosure fabrication.

3. Sill Flashing: Fabricate to configuration indicated and required of minimum 0.040 inch aluminum having exposed edges hemmed. Finish shall match adjacent related work.

2.6 FINISHES
A. Comply with NAAMM "Metal Finishes Manual" for recommendations relative to applying and designating finishes.

B. Finish designations prefixed by AA conform to the system established by the Aluminum Association for designating aluminum finishes.

C. High-Performance Organic Coating Finish: AA-C12C42R1x (Chemical Finish: cleaned with inhibited chemicals; Chemical Finish: acid chromate-fluoride-phosphate conversion coating; Organic Coating: as specified below). Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturer's instructions.
   1. Fluoropolymer 3-Coat Coating System: Manufacturer's standard 3-coat, thermocured system composed of specially formulated inhibitive primer, fluoropolymer color coat, and clear fluoropolymer topcoat, with both color coat and clear topcoat containing not less than 70 percent polyvinylidene fluoride resin by weight; complying with AAMA 605.2.
   2. Color and Gloss: As selected by Architect from manufacturer's full range of choices for color and gloss.

PART 3 - EXECUTION
3.1 EXAMINATION
A. Verify wall openings are ready to receive work of this Section. Verify dimensions, tolerances, and method of attachment with other work.

B. Beginning of installation means acceptance of existing conditions.

3.2 INSTALLATION
A. Install storefront system components in accordance with manufacturer's instructions.

B. Use anchorage devices to securely attach frame assembly to structure.

C. Align assembly plumb and level, free of warp or twist. Maintain assembly dimensional tolerances, aligning with adjacent work.

D. Break Metals:
   1. Set sill flashing in full bed of sealant. Provide riveted end laps of not less than 3 inches.

E. Pack fibrous insulation in shim spaces at perimeter of assembly to maintain continuity of thermal barrier.

F. Install perimeter sealant and backing materials in accordance with Section 07900.

G. Install glass in accordance with Section 08800, to glazing method required to achieve performance criteria.

H. Install hardware using templates provided and in accordance with disabled access regulatory requirements for hardware. Refer to Section 08712 for cylinders and installation requirements.
   1. Cylinder and Thumb Turn: 48 inches above finished floor.
I. Set thresholds in bed of mastic and secure.

J. Adjust operating hardware and crash bars for smooth operation.

3.3 TOLERANCES

A. Variation from Plane: 0.03 inches per foot maximum or 0.25 inches per 30 feet, whichever is less.

B. Misalignment of Two Adjoining Members Abutting in Plane: 0.015 inches.

3.4 FIELD QUALITY CONTROL

A. Inspect storefront system installation and attachment to building structure.

B. Inspect door operation and hardware installation.

3.5 CLEANING

A. Wash down exposed surfaces using a solution of mild detergent in warm water, applied with soft, clean wiping cloths. Take care to remove dirt from corners. Wipe surfaces clean.

B. Remove excess sealant by moderate use of mineral spirits or other solvent acceptable to sealant manufacturer.

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 1 Specification Sections, apply to this Section.

1.2 SUMMARY
A. This Section includes Architectural Grade aluminum windows of the performance class indicated. Window types required include the following:

1.3 DEFINITIONS
A. Performance class number, included as part of the window designation system, is the actual design pressure in pounds force per square foot (pascals) used to determine structural test pressure and water test pressure.
   1. Structural test pressure, wind load test, is equivalent to 150 percent of the design pressure.
   2. Water-leakage-resistance test pressure is equivalent to 15 percent of the design pressure with 2.86 lbf/sq. ft. (137 Pa) as a minimum for Residential, Commercial, and Heavy-Commercial Grade windows.

1.4 PERFORMANCE REQUIREMENTS
A. General: Provide aluminum windows engineered, fabricated, and installed to withstand normal thermal movement, wind loading, and impact loading without failure, as demonstrated by testing manufacturer's standard window assemblies representing types, grades, classes, and sizes required for Project according to test methods indicated.

B. Test Criteria: Testing shall be performed by a qualified independent testing agency based on the following criteria:
   1. Design wind velocity at Project site is 70 mi./h (113 km/h).
   2. Test Procedures: Test window units according to ASTM E 283 for air infiltration, ASTM E 547 for water penetration, and ASTM E 330 for structural performance.

C. Performance Requirements: Testing shall demonstrate compliance with requirements indicated in AAMA 101 for air infiltration, water penetration, and structural performance for type, grade, and performance class of window units required. Where required design pressure exceeds the minimum for the specified window grade, comply with requirements of AAMA 101, Section 3, "Optional Performance Classes," for higher than minimum performance class.
   1. Air-Infiltration Rate for Fixed Windows: Not more than 0.15 cfm/ft. (2.74 cu. m/h per m) of area for an inward test pressure of 6.24 lbf/sq. ft. (299 Pa).
   2. Air-Infiltration Rate for Operating Units: Not more than 0.10 cfm/ft. (0.56 cu. m/h per m) of operable sash joint for an inward test pressure of 6.24 lbf/sq. ft. (299 Pa).
   3. Water Penetration: No water penetration as defined in the test method at an inward test pressure of 15 percent of the design pressure.
   4. Uniform Load Deflection: No deflection in excess of 1/175 of any member's span during the imposed load, for a positive (inward) and negative (outward) test pressure of 60 lbf/sq. ft.
   5. Condensation Resistance: Where window units are indicated to be "thermally improved," provide units tested for thermal performance according to AAMA 1503.1
showing a condensation resistance factor (CRF) of 45.

6. Thermal Transmittance: Provide window units with a U-value maximum of 0.69 Btu/sq. ft. x h x deg F (3.9 W/sq. m x K) at 15-mi./h (24-km/h) exterior wind velocity, when tested according to AAMA 1503.1.

7. Thermal Movements: Provide window units that allow thermal movement resulting from the following maximum change (range) in ambient temperature when engineering, fabricating, and installing aluminum windows to prevent buckling, opening of joints, and overstressing of components, connections, and other detrimental effects. Base engineering calculation on actual surface temperatures of materials due to solar heat gain and nighttime sky heat loss.
   a. Temperature Change (Range): 120 deg F (67 deg C), ambient; 180 deg F (100 deg C), material surfaces.

8. Sound-Insulation Construction: Provide window units certified to provide a Sound Transmission Class (STC) rating of at least 40 when tested according to ASTM E 90 and classified according to ASTM E 413.

1.5 SUBMITTALS

A. General: Submit each item in this Article according to the Conditions of the Contract and Division 1 Specification Sections.

B. Product Data for each type of window required, including the following:
   1. Construction details and fabrication methods.
   2. Profiles and dimensions of individual components.
   3. Data on hardware, accessories, and finishes.
   4. Recommendations for maintaining and cleaning exterior surfaces.

C. Shop Drawings showing fabrication and installation of each type of window required including information not fully detailed in manufacturer's standard Product Data and the following:
   1. Layout and installation details, including anchors.
   2. Elevations at 1/4 inch = 1 foot (1:50) scale and typical window unit elevations at 3/4 inch = 1 foot (1:20) scale.
   3. Full-size section details of typical composite members, including reinforcement and stiffeners.
   4. Location of weep holes.
   5. Panning details.
   6. Hardware, including operators.
   7. Window cleaning provisions.
   8. Glazing details.

D. Samples for initial color selection on 12-inch- (300-mm-) long sections of window members. Where finishes involve normal color variations, include Sample sets showing the full range of variations expected.

1.6 QUALITY ASSURANCE

A. Installer Qualifications: Engage an experienced Installer who has completed installation of aluminum windows similar in material, design, and extent to those required for this Project and with a record of successful in-service performance.
B. **Product Options:** The Drawings indicate sizes, profiles, dimensional requirements, and aesthetic effects of aluminum windows and are based on the specific window types and models indicated. Other aluminum window manufacturers whose products have equal performance characteristics may be considered provided deviations in size, profile, and dimensions are minor and do not alter the aesthetic effect. Refer to Division 1 Section "Substitutions."

### 1.7 PROJECT CONDITIONS

A. **Field Measurements:** Check window openings by field measurements before fabrication and show recorded measurements on Shop Drawings. Coordinate fabrication schedule with construction progress to avoid delaying the Work.

1. Where field measurements cannot be made without delaying the Work, guarantee opening dimensions and proceed with fabricating aluminum windows without field measurements. Coordinate wall construction to ensure that actual opening dimensions correspond to guaranteed dimensions.

### 1.8 WARRANTY

A. **General Warranty:** The special warranty specified in this Article shall not deprive the Owner of other rights the Owner may have under other provisions of the Contract Documents and shall be in addition to, and run concurrent with, other warranties made by the Contractor under requirements of the Contract Documents.

B. **Special Warranty:** Submit a written warranty signed by aluminum window manufacturer agreeing to repair or replace window components that fail in materials or workmanship within the specified warranty period. Failures include, but are not limited to, the following:

1. Structural failures including excessive deflection, water leakage, air infiltration, or condensation.
2. Faulty operation of sash and hardware.
3. Deterioration of metals, metal finishes, and other materials beyond normal weathering.

C. **Warranty Period:** 3 years after date of Substantial Completion.

D. **Warranty Period for Metal Finishes and Glass:** 5 years after date of Substantial Completion.

### PART 2 - PRODUCTS

#### 2.1 MANUFACTURERS

A. **Manufacturers:** Subject to compliance with requirements, provide products by one of the following:

1. Double-Hung (Single-Hung and Triple-Hung) Windows:
   a. Acorn Window Systems.
   b. Alenco Commercial Division.
   c. Capitol Products Corp.
   d. Custom Window Company.
   e. EFCO Corporation.
   g. Peerless Products, Inc.
   h. TRACO.
2.2 MATERIALS

A. Aluminum Extrusions: Provide alloy and temper recommended by manufacturer for strength, corrosion resistance, and application of required finish, but not less than 22,000-psi (150-MPa) ultimate tensile strength and not less than 0.062 inch (1.6 mm) thick at any location for main frame and sash members.

B. Fasteners: Provide aluminum, nonmagnetic stainless steel, epoxy adhesive, or other materials warranted by manufacturer to be noncorrosive and compatible with aluminum window members, trim, hardware, anchors, and other components of window units.
   1. Reinforcement: Where fasteners screw anchor into aluminum less than 0.125 inch (3.2 mm) thick, reinforce interior with aluminum or nonmagnetic stainless steel to receive screw threads or provide standard, noncorrosive, pressed-in, splined grommet nuts.
   2. Exposed Fasteners: Except where unavoidable for application of hardware, do not use exposed fasteners. For application of hardware, use fasteners that match finish of member or hardware being fastened, as appropriate.

C. Anchors, Clips, and Window Accessories: Fabricate anchors, clips, and window accessories of aluminum, nonmagnetic stainless steel, or hot-dip zinc-coated steel or iron complying with requirements of ASTM B 633; provide sufficient strength to withstand design pressure indicated.

D. Compression-Type Glazing Strips and Weatherstripping: Unless otherwise indicated, and at manufacturer's option, provide compressible stripping for glazing and weatherstripping such as molded EPDM or neoprene gaskets complying with ASTM D 2000 Designation 2BC415 to 3BC620, or molded PVC gaskets complying with ASTM D 2287, or molded expanded EPDM or neoprene gaskets complying with ASTM C 509, Grade 4.

E. Sealant: For sealants required within fabricated window units, provide type recommended by manufacturer for joint size and movement. Sealant shall remain permanently elastic, nonshrinking, and nonmigrating. Comply with Division 7 Section "Joint Sealants" of these Specifications for selection and installation of sealants.

2.3 HARDWARE

A. General: Provide manufacturer's standard hardware fabricated from aluminum, stainless steel, or other corrosion-resistant material compatible with aluminum and of sufficient strength to perform the function for which it is intended.

B. Counterbalancing Mechanism: Comply with AAMA 902.2. Provide one of the following:
   1. Sash-Balance Type: Concealed block-and-tackle type of size and capacity to hold sash stationary at any open position.
   2. Sash-Balance Type: Concealed-spiral type of size and capacity to hold sash stationary at any open position.
   3. Sash-Balance Type: Concealed-tape-spring type of size and capacity to hold sash stationary at any open position.

2.4 ACCESSORIES

A. General: Provide manufacturer's standard accessories that comply with indicated standards.
B. Weatherstripping: Provide sliding-type weatherstripping where sash rails slide horizontally or vertically along unit frame. Provide compression-type weatherstripping at perimeter of each operating sash where sliding type is inappropriate.
   1. Provide weatherstripping locked into extruded grooves in sash.

2.5 DOUBLE-HUNG WINDOWS (SINGLE-HUNG)

A. Window Grade and Class: Comply with requirements of AAMA Grade and Performance Class DH-DW-HC40. Window units shall successfully pass operating force and deglazing test performance requirements specified in AAMA 101.

B. Window Grade and Class: Comply with requirements of AAMA Grade and Performance Class DH-AW40. Window units shall successfully pass operating force test performance requirements specified in AAMA 101 and life-cycle test requirements specified in AAMA 910.
   1. Provide window units with tilt-in feature permitting both sides of sash to be cleaned from interior.

C. Hardware: Provide the following equipment and operating hardware:
   1. Sash Balances: Manufacturer's standard type (2 per sash).
   2. Sash Lock: Cam-action sweep lock and keeper on meeting rail.
   3. Sash Lock: Pole-operated, cam-action locking device on meeting rail of windows with meeting rail more than 72 inches (1800 mm) above floor.
   4. Tilt Lock: Tamperproof, key-operated tilt mechanism to permit sash to tilt inward for cleaning.
   5. Lift Handle: Continuous, integral, sash lift bar on bottom rail of lower sash.
   6. Pull-Down Handles: Continuous, integral handle on bottom rail of lower sash.
   7. Pole Socket: Provide a pole socket or groove on inside face of top rail of upper sash on window units with meeting rails more than 72 inches (1800 mm) above floor.

2.6 FABRICATION

A. General: Fabricate aluminum window units to comply with indicated standards. Include a complete system for assembly of components and anchorage of window units.
   1. Provide units that are reglazable without dismantling sash or ventilator framing.
   2. Prepare window sash or ventilators for glazing, except where preglazing at the factory is indicated.

B. Thermally Improved Construction: Fabricate window units with an integral, concealed, low-conductance, thermal barrier, located between exterior materials and window members exposed on interior, in a manner that eliminates direct metal-to-metal contact.
   1. Provide thermal-break construction that has been in use for not less than 3 years, has been tested to demonstrate resistance to thermal conductance and condensation, and has been tested to show adequate strength and security of glass retention.
   2. Provide hardware with low conductivity or nonmetallic material for hardware bridging thermal breaks at frame or vent sash.
   3. Weep Holes: Provide weep holes and internal passages to conduct infiltrating water to exterior.
   4. Provide water-shed members above side-hinged ventilators and similar lines of natural water penetration.
   5. Subframes: Provide subframes with anchors for window units as shown, of profile and dimensions indicated but not less than 0.062-inch- (1.6-mm-) thick extruded aluminum.
Miter or cope corners, and weld and dress smooth with concealed mechanical joint fasteners. Finish to match window units.

6. Mullions: Provide mullions and cover plates as shown, matching window units, complete with anchors for support to structure and installation of window units. Allow for erection tolerances and provide for movement of window units due to thermal expansion and building deflections, as indicated.

C. Preglazed Fabrication: Preglaze window units at the factory where possible and practical for applications indicated. Comply with glass and glazing requirements of Division 8 Section “Glazing” of these Specifications and AAMA 101.

2.8 FINISHES

A. Comply with NAAMM "Metal Finishes Manual" for recommendations relative to applying and designating finishes.

B. Finish designations prefixed by AA conform to the system established by the Aluminum Association for designating aluminum finishes.

C. High-Performance Organic Coating Finish: AA-C12C42R1x (Chemical Finish: cleaned with inhibited chemicals; Chemical Finish: acid chromate-fluoride-phosphate conversion coating; Organic Coating: as specified below). Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturer's instructions.

1. Fluoropolymer 3-Coat Coating System: Manufacturer's standard 3-coat, thermocured system composed of specially formulated inhibitive primer, fluoropolymer color coat, and clear fluoropolymer topcoat, with both color coat and clear topcoat containing not less than 70 percent polyvinylidene fluoride resin by weight; complying with AAMA 605.2.

2. Color and Gloss: As selected by Architect from manufacturer's full range of choices for color and gloss.

PART 3 - EXECUTION

3.1 INSPECTION

A. Inspect openings before installation. Verify that rough or masonry opening is correct and sill plate is level.

1. Masonry surfaces shall be visibly dry and free of excess mortar, sand, and other construction debris.

2. Wood frame walls shall be dry, clean, sound, well nailed, free of voids, and without offsets at joints. Ensure nail heads are driven flush with surfaces in opening and within 3 inches (75 mm) of opening.

3. Metal surfaces shall be dry; clean; free of grease, oil, dirt, rust and corrosion, and welding slag; without sharp edges or offsets at joints.

3.2 INSTALLATION

A. Comply with manufacturer's specifications and recommendations for installing window units, hardware, operators, and other components of the Work.

B. Set window units plumb, level, and true to line, without warp or rack of frames or sash. Provide
proper support and anchor securely in place.
1. Separate aluminum and other corrodible surfaces from sources of corrosion or electrolytic
action at points of contact with other materials by complying with requirements specified
under "Dissimilar Materials" Paragraph in appendix to AAMA 101.

C. Set sill members and other members in a bed of sealant or with joint fillers or gaskets, as shown
on Shop Drawings, to provide weathertight construction. Refer to Division 7 Section "Joint
Sealants" for compounds, fillers, and gaskets to be installed concurrently with window units.
Coordinate installation with wall flashings and other components of the Work.
1. Sealants, joint fillers, and gaskets to be installed after installation of window units are
specified in another Division 7 Section.

3.3 ADJUSTING
A. Adjust operating sash and hardware to provide a tight fit at contact points and at weatherstripping
for smooth operation and a weathertight closure.

3.4 CLEANING
A. Clean aluminum surfaces promptly after installing windows. Exercise care to avoid damage to
protective coatings and finishes. Remove excess glazing and sealant compounds, dirt, and other
substances. Lubricate hardware and other moving parts.
B. Clean glass of preglazed units promptly after installing windows. Comply with requirements of
Division 8 Section "Glazing" for cleaning and maintenance.

3.5 PROTECTION
A. Provide final protection and maintain conditions, in a manner acceptable to aluminum window
manufacturer, that ensure window units are without damage or deterioration at the time of
Substantial Completion.

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 1 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes the following:

1. Commercial door hardware for the following:
   a. Swinging doors.

B. Related Sections include the following:

1. Section 08110 - Steel Doors and Frames: for door silencers provided as part of the frame.
2. Section 08211 - Flush Wood Doors.

C. Products furnished, but not installed, under this Section include the following. Coordinating, purchasing, delivering, and scheduling remain requirements of this Section.

1. Final replacement cores and keys to be installed by Owner.

1.3 SUBMITTALS

A. Product Data: Include installation details, material descriptions, dimensions of individual components and profiles, and finishes.

B. Samples for Initial Selection: Manufacturer's color charts consisting of units or sections of units showing the full range of colors, textures, and patterns available for each type of door hardware indicated.

C. Samples: For exposed door hardware of each type indicated below, in specified finish, full size. Tag with full description for coordination with the Door Hardware Schedule. Submit samples before, or concurrent with, submission of the final Door Hardware Schedule.

1. Door Hardware: As follows:
   a. Hinges.
   b. Locks and latches.
   c. Bolts.
   d. Exit devices.
   e. Cylinders and keys.
   f. Operating trim.
   g. Closers.
h. Stops and holders.
i. Protective trim.
j. Door gasketing.
k. Thresholds.
l. KeyScan Card Reader (see Door Schedule for locations)

2. Samples will be returned to Contractor. Units that are acceptable and remain undamaged through submittal, review, and field comparison process may, after final check of operation, be incorporated into the Work, within limitations of keying requirements.

D. Door Hardware Schedule: Prepared by or under the supervision of supplier, detailing fabrication and assembly of door hardware, as well as procedures and diagrams. Coordinate the final Door Hardware Schedule with doors, frames, and related work to ensure proper size, thickness, hand, function, and finish of door hardware.

1. Format: Comply with scheduling sequence and vertical format in DHI's "Sequence and Format for the Hardware Schedule."
2. Organization: Organize the Door Hardware Schedule into door hardware sets indicating complete designations of every item required for each door or opening.
   a. Organize door hardware sets in same order as in the Door Hardware Schedule at the end of Part 3.

3. Content: Include the following information:
   a. Type, style, function, size, label, hand, and finish of each door hardware item.
   b. Manufacturer of each item.
   c. Fastenings and other pertinent information.
   d. Location of each door hardware set, cross-referenced to Drawings, both on floor plans and in door and frame schedule.
   e. Explanation of abbreviations, symbols, and codes contained in schedule.
   f. Mounting locations for door hardware.
   g. Door and frame sizes and materials.

4. Submittal Sequence: Submit initial draft of final schedule along with essential Product Data to facilitate the fabrication of other work that is critical in the Project construction schedule. Submit the final Door Hardware Schedule after Samples, Product Data,

5. Coordination with Shop Drawings of other work, delivery schedules, and similar information has been completed and accepted.

E. Keying Schedule: Prepared by or under the supervision of supplier, detailing Owner's final keying instructions for locks. Include schematic keying diagram and index each key set to unique door designations.

F. Qualification Data: For firms and persons specified in "Quality Assurance" Article.

G. Maintenance Data: For each type of door hardware to include in maintenance manuals specified in Division 1.
H. Warranties: Special warranties specified in this Section. Coordinate with Warranties of Division 1.

1.4 QUALITY ASSURANCE

A. Installer Qualifications: An experienced installer who has completed door hardware similar in material, design, and extent to that indicated for this Project and whose work has resulted in construction with a record of successful in-service performance.

B. Supplier Qualifications: Door hardware supplier with warehousing facilities in Project's vicinity and who is or employs a qualified Architectural Hardware Consultant, available during the course of the Work to consult with Contractor, Architect, and Owner about door hardware and keying.

1. Scheduling Responsibility: Preparation of door hardware and keying schedules.

C. Regulatory Requirements: Comply with provisions of the following:

1. Where indicated to comply with accessibility requirements, comply with Americans with Disabilities Act (ADA), "Accessibility Guidelines for Buildings and Facilities (ADAAG)," ANSI A117.1, FED-STD-795, "Uniform Federal Accessibility Standards," as follows:

   a. Handles, Pulls, Latches, Locks, and other Operating Devices: Shape that is easy to grasp with one hand and does not require tight grasping, tight pinching, or twisting of the wrist.

   b. Door Closers: Comply with the following maximum opening-force requirements indicated:

      1) Interior Hinged Doors: 5 lbf (22.2 N) applied perpendicular to door.

      2) Fire Doors: Minimum opening force allowable by authorities having jurisdiction.

   c. Thresholds: Not more than 1/2 inch (13 mm) high Bevel raised thresholds with a slope of not more than 1:2.

2. NFPA 101: Comply with the following for means of egress doors:

   a. Latches, Locks, and Exit Devices: Not more than 15 lbf (67 N) to release the latch. Locks shall not require the use of a key, tool, or special knowledge for operation.

   b. Door Closers: Not more than 30 lbf (133 N) to set door in motion and not more than 15 lbf (67 N) to open door to minimum required width.

   c. Thresholds: Not more than 1/2 inch (13 mm) high.

D. Fire-Rated Door Assemblies: Provide door hardware for assemblies complying with NFPA 80 that are listed and labeled by a testing and inspecting agency acceptable to authorities having jurisdiction, for fire ratings indicated, based on testing according to NFPA 252.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Inventory door hardware on receipt and provide secure lock-up for door hardware delivered to Project site.
B. Tag each item or package separately with identification related to the final Door Hardware Schedule, and include basic installation instructions with each item or package.

1.6 COORDINATION

A. Templates: Obtain and distribute to the parties involved templates for doors, frames, and other work specified to be factory prepared for installing 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.

1.7 WARRANTY

A. General Warranty: Special warranties specified in this Article shall not deprive Owner of other rights Owner may have under other provisions of the Contract Documents and shall be in addition to, and run concurrent with, other warranties made by Contractor under requirements of the Contract Documents.

B. Special Warranty: Written warranty, executed by manufacturer agreeing to repair or replace components of door hardware that fail in materials or workmanship within specified warranty period. Failures include, but are not limited to, the following:

1. Structural failures including excessive deflection, cracking, or breakage.
2. Faulty operation of operators and door hardware.
3. Deterioration of metals, metal finishes, and other materials beyond normal weathering.

C. Warranty Period: Three years from date of Substantial Completion, unless otherwise indicated.

D. Warranty Period for Manual Closers: 10 years from date of Substantial Completion.

1.8 MAINTENANCE SERVICE

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.

PART 2 - PRODUCTS

2.1 HINGES AND PIVOTS, GENERAL

A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

1. Hinges:
   a. Baldwin Hardware Corporation.
   b. Bommer Industries, Inc.
   c. Hager Companies.
d. McKinney Products Company; Div. of ESSEX Industries, Inc.
e. Sargent Manufacturing Company; Div. of ESSEX Industries, Inc.

B. Standards: Comply with the following:

2. Template Hinge Dimensions: BHMA A156.7.

C. Quantity: Provide the following, unless otherwise indicated:

1. Three Hinges: For doors with heights 61 to 90 inches (1549 to 2286 mm).

D. Size: Provide the following, unless otherwise indicated, with hinge widths sized for door thickness and clearances required:

<table>
<thead>
<tr>
<th>Maximum Door Size (inches)</th>
<th>Hinge Height (inches)</th>
<th>Metal Thickness (inches)</th>
<th>Standard Weight</th>
<th>Heavy Weight</th>
</tr>
</thead>
<tbody>
<tr>
<td>32 by 84 by 1-3/8</td>
<td>3-1/2</td>
<td>0.123</td>
<td></td>
<td></td>
</tr>
<tr>
<td>36 by 84 by 1-3/8</td>
<td>4</td>
<td>0.130</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

E. Template Requirements: Except for hinges and pivots to be installed entirely (both leaves) into wood doors and frames, provide only template-produced units.

F. Hinge Applications: Unless otherwise indicated, provide the following:

1. Entrance Doors: Heavy-weight hinges.
2. Doors with Closers: Antifriction-bearing hinges.

G. Hinge Base Metal: Unless otherwise indicated, provide the following:

1. Exterior Hinges: Brass, with stainless-steel pin body and brass protruding heads.
2. Interior Hinges: Brass, with stainless-steel pin body and brass protruding heads.

H. Hinge Options: Comply with the following where indicated in the Door Hardware Schedule or on Drawings:

1. Nonremovable Pins: Provide set screw in hinge barrel that, when tightened into a groove in hinge pin, prevents removal of pin while door is closed; for the following applications:
   a. Outswinging exterior doors.
2. Corners: Square 5/32-inch (4-mm) radius.

I. Fasteners: Comply with the following:

2. Wood Screws: For wood doors and frames.
3. Threaded-to-the-Head Wood Screws: For fire-rated wood doors.
4. Screws: Phillips flat-head screws; machine screws (drilled and tapped holes) for metal doors. Finish screw heads to match surface of hinges.

### 2.2 HINGES

A. Antifriction-Bearing, Full-Mortise (Butt) Hinges: Heavy weight; BHMA Grade 1, with 4 ball bearings; button tips; nonrising removable pins; and base metal as follows:

1. Base Metal: Cast, forged, or extruded brass or bronze.

B. Plain-Bearing, Standard-Weight, Full-Mortise (Butt) Hinges: BHMA Grade 3, button tips, nonrising removable pins, and base metal as follows:

1. Base Metal: Cast, forged, or extruded brass or bronze.

### 2.3 LOCKS AND LATCHES, GENERAL

A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

1. Mechanical Locks and Latches:
   a. Best Lock Corporation.
   b. Or approved equal.

B. Standards: Comply with the following:

1. Mortise Locks and Latches: ANSI/BHMA A156.13, Grade 1 Series 1000.
2. Cylindrical Locks: ANSI/BHMA A156.2, Grade 1 Series 4000.
3. Auxiliary Locks: BHMA A156.5, Grade 1
4. Exit Locks: BHMA A156.5.
5. Push button Locks: 5 button with key override, by American Locksets. Simplex L1000 series or approved equal.

C. Lock Trim: Comply with the following:

1. Lever: Wrought, forged, or cast.
2. Escutcheon (Rose): Wrought, forged, or cast.
3. Dummy Trim: Match lock trim and escutcheons.

D. Lock Functions: Function numbers or descriptions indicated in the Door Hardware Schedule comply with the following:

2. Cylindrical Locks: BHMA A156.2

E. Lock Throw: Comply with testing requirements for length of bolts to comply with labeled fire door requirements, and as follows:

1. Mortise Locks:
   a. 3/4-inch (19-mm) latchbolt throw.
   b. 1-inch (25-mm) deadbolt throw.

2. Cylindrical Locks: Provide deadlocking unless noted otherwise.
   a. 1/2-inch (13-mm) plain latchbolt throw.
b. 1/2-inch (13-mm) deadlocking latchbolt throw.

F. Backset: 2-3/4 inches (70 mm), unless otherwise indicated.

2.4 DOOR BOLTS, GENERAL

A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

1. Flush Bolts:
   a. Adams Rite Manufacturing Co.
   b. Glynn-Johnson; an Ingersoll-Rand Company.
   c. Hager Companies.
   d. Ives: H. B. Ives.

B. Standards: Comply with the following:

2.5 EXIT DEVICES, GENERAL

A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

1. Securitron Magnalock Corp.
2. Or approved equal

B. Standard: BHMA A156.3.

C. Certified Products: Provide exit devices listed in BHMA’s "Directory of Certified Exit Devices."

D. Panic Exit Devices: Listed and labeled by a testing and inspecting agency acceptable to authorities having jurisdiction, for panic protection, based on testing according to UL 305.

E. Fire Exit Devices: Complying with NFPA 80 that are listed and labeled by a testing and inspecting agency acceptable to authorities having jurisdiction, for fire and panic protection, based on testing according to UL 305 and NFPA 252.

F. Outside Trim: Lever with cylinder; material and finish to match locksets, unless otherwise indicated.
   1. Match design for locksets and latchsets, unless otherwise indicated.

2.6 EXIT DEVICES

A. Rim Exit Devices:
   1. Securitron TS2T
2.7 CYLINDERS AND KEYING

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   1. Cylinders:
      a. Best Lock Corporation.
      b. Or approved equal.

B. Standards: Comply with the following:
   1. Cylinders: BHMA A156.5.

C. Cylinders: Manufacturer's standard tumbler type, constructed from brass or bronze, stainless steel, or nickel silver, and complying with the following:
   1. Number of Pins: Seven.
   2. Mortise Type: Threaded cylinders with rings and straight- or clover-type cam.
   3. Rim Type: Cylinders with back plate, flat-type vertical or horizontal tailpiece, and raised trim ring.

D. Permanent Cores: Manufacturer's standard; finish face to match lockset; complying with the following:
   1. Removable Cores: Core insert, removable by use of a special key, and for use with only the core manufacturer's cylinder and door hardware.

E. Construction Keying: Comply with the following:
   1. Construction Cores: Provide construction cores that are replaceable by permanent cores. Provide 10 construction master keys.
      a. Furnish permanent cores to Owner for installation.

F. Keying System: Unless otherwise indicated, provide a factory-registered keying system complying with the following requirements:
   1. Grand Master Key System: Cylinders are operated by a change key, a master key, and a grand master key.
   2. Existing System: Master key or grand master key locks to Owner's existing system.
      a. Cylinders shall be master keyed.

G. Keys: Provide nickel-silver keys complying with the following:
   1. Stamping: Permanently inscribe each key with a visual key control number and include the following notation:
      a. Notation: "DO NOT DUPLICATE."
      b. Quantity: In addition to one extra blank key for each lock, provide the following:
      d. Master Keys: Five.

H. Key Control System: BHMA Grade 1 system, including key-holding hooks, labels, two sets of key tags with self-locking key holders, key-gathering envelopes, and temporary and permanent markers. Contain system in metal cabinet with baked-enamel finish.
1. Portable Cabinet: Tray for mounting in file cabinet, equipped with key-holding panels, envelopes, and cross-index system.
2. Capacity: Able to hold keys for 150 percent of the number of locks.

2.8 STRIKES

A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

B. Standards: Comply with the following:
   3. Dustproof Strikes: BHMA A156.16.
   4. Electric Strikes:

C. Strikes: Provide manufacturer's standard strike with strike box for each latch or lock bolt, with curved lip extended to protect frame, finished to match door hardware set, unless otherwise indicated, and as follows:

D. Dustproof Strikes: BHMA Grade 1, complying with the following:
   1. Jamb Type: Polished wrought brass, with 3/4-inch- (19-mm-) diameter, spring-tension plunger.

2.9 ACCESSORIES FOR PAIRS OF DOORS, GENERAL

A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

1. Astragals:
   a. Hager Companies.
   b. National Guard Products, Inc.
   c. Pemko Manufacturing Co., Inc.
   d. Reese Enterprises, Inc.
   e. Ultra Industries; a Macklanburg-Duncan Company.

2.10 ACCESSORIES FOR PAIRS OF DOORS

A. Overlapping-with-Gasket Astragals: T-shaped metal, surface mounted on edge of door with screws; with integral gasket; and base metal as follows:


2.11 CLOSERS, GENERAL
A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

1. Surface-Mounted Closers:
   a. Arrow Architectural Hardware; Div. of ESSEX Industries, Inc.
   b. LCN Closers; an Ingersoll-Rand Company.
   c. Norton Door Controls; Div. of Yale Security Inc.
   d. Rixson-Firemark, Inc.; Div. of Yale Security Inc.
   e. Sargent Manufacturing Company; Div. of ESSEX Industries, Inc.
   f. Yale Security Inc.; Div. of Williams Holdings.

B. Standards: Comply with the following:

1. Closers: BHMA A156.4.

C. Surface Closers: BHMA Grade 1.

2.12 CLOSERS

A. Modern-Type-with-Cover Surface Closers: Rack-and-pinion hydraulic type; with adjustable sweep and latch speeds controlled by key-operated valves; with forged-steel main arm; enclosed in cover indicated; complying with the following:

1. Mounting: Hinge side, top jamb.
2. Type: Regular arm.
3. Backcheck: Adjustable, effective between 60 and 85 degrees of door opening.
5. Closing Power Adjustment: At least more than minimum tested value.

2.13 PROTECTIVE TRIM UNITS, GENERAL

A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

1. Metal Protective Trim Units:
   a. Hiawatha, Inc.
   b. IPC Door and Wall Protection Systems, Inc.
   c. Ives: H. B. Ives.
   d. NT Quality Hardware; an Ingersoll-Rand Company.
   e. Pawling Corporation.
   f. Rockwood Manufacturing Company.

B. Standard: Comply with BHMA A156.6.

C. Materials: Fabricate protection plates from the following:

1. Bronze: 0.050 inch (1.3 mm) thick; beveled top and 2 sides.
   a. Color and Texture: As selected by Architect from manufacturer's full range.

D. Fasteners: Provide manufacturer's standard exposed fasteners for door trim units consisting of either machine or self-tapping screws.
E. Furnish protection plates sized 1-1/2 inches (38 mm) less than door width on push side and 1/2 inch (13 mm) less than door width on pull side, by height specified in schedule.

2.14 PROTECTIVE TRIM UNITS

A. Kick Plates: 12 inches (305 mm) high by door width unless noted otherwise, with allowance for frame stops.

B. Mop Plates: 6 inches (152 mm) high by 1 inch (25 mm) less than door width, unless noted otherwise.

2.15 STOPS AND HOLDERS, GENERAL

A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

1. Architectural Builders Hardware Mfg., Inc.
2. Glynn-Johnson; an Ingersoll-Rand Company.
3. Hager Companies.
5. Yale Security Inc.; Div. of Williams Holdings.

B. Standards: Comply with the following:

1. Stops and Bumpers: BHMA A156.16.
2. Combination Overhead Holders and Stops: BHMA A156.8.
3. Door Silencers: BHMA A156.16.

C. Combination Overhead Stops and Holders: BHMA Grade 1, unless Grade 2 is indicated.

D. Silencers for Metal Door Frames: BHMA Grade 1; neoprene or rubber, minimum diameter 1/2 inch (13 mm); fabricated for drilled-in application to frame.

2.16 STOPS AND HOLDERS

A. Lever-Type Door Holders: Polished cast brass, bronze, or aluminum; consisting of 4-inch- (102-mm-) long arm that swings up and remains in vertical position; with replaceable rubber tip; surface-screw application.

2.17 OVERHEAD STOPS AND HOLDERS

A. Overhead Surface-Mounted, Jointed-Arm Stops: Release by push and pull of door; control capable of being set in inactive position; with stop and shock absorber; for single-acting doors opening 110 degrees.

2.18 WALL BUMPERS
A. Wrought, finish to match lock trim.
B. Rubber
C. Concealed mounting.

2.19 DOOR GASKETING, GENERAL

A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

1. Door Gasketing:
   a. National Guard Products, Inc.
   b. Pemko Manufacturing Co., Inc.
   c. Reese Enterprises, Inc.
   d. Sealeze Corporation.
   e. Zero International, Inc.

2. Door Bottoms:
   a. Hager Companies.
   b. National Guard Products, Inc.
   c. Pemko Manufacturing Co., Inc.
   d. Reese Enterprises, Inc.
   e. Zero International, Inc.

B. Standard: Comply with BHMA A156.22.

C. General: Provide continuous weather-strip gasketing on exterior doors and provide smoke, light, or sound gasketing on interior doors where indicated or scheduled. Provide noncorrosive fasteners for exterior applications and elsewhere as indicated.

1. Perimeter Gasketing: Apply to head and jamb, forming seal between door and frame.
2. Door Bottoms: Apply to bottom of door, forming seal with threshold when door is closed.

D. Air Leakage: Not to exceed 0.50 cfm per foot (0.000774 cu. m/s per m) of crack length for gasketing other than for smoke control, as tested according to ASTM E 283.

E. Fire-Labeled Gasketing: Assemblies complying with NFPA 80 that are listed and labeled by a testing and inspecting agency acceptable to authorities having jurisdiction, for fire ratings indicated, based on testing according to UL 10B or NFPA 252.

F. Sound-Rated Gasketing: Assemblies that are listed and labeled by a testing and inspecting agency, for sound ratings indicated, based on testing according to ASTM E 1408.

G. Replaceable Seal Strips: Provide only those units where resilient or flexible seal strips are easily replaceable and readily available from stocks maintained by manufacturer.

2.20 DOOR GASKETING

A. Rigid, Housed Perimeter Gasketing: Gasket material held in place by metal housing; fastened to frame stop with screws.

B. Door Sweeps: Gasket material held in place by flat metal housing or flange; surface mounted to face of door with screws.
   2. Housing Material: Bronze.

C. Automatic Door Bottoms: Gasket material held in place by metal housing that automatically drops to form seal when door is closed; mounted to bottom edge of door with screws.
   2. Housing Material: Aluminum with 0.047-inch (1.2-mm) lead lining.
   3. Mounting: Surface mounted on face of door.
   4. Type: Low-closing-force type for doors required to meet accessibility requirements.

2.21 THRESHOLDS, GENERAL

A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
   1. National Guard Products, Inc.
   2. NT Dor-O-Matic Hardware Div.; an Ingersoll-Rand Company.
   3. Pemko Manufacturing Co., Inc.
   4. Reese Enterprises, Inc.

B. Standard: Comply with BHMA A156.21.

2.22 THRESHOLDS

A. Ramped Thresholds: Modular, interlocking, sloped, fluted-top metal assemblies with closed return ends; 1:12 slope; and Aluminum base metal.

2.23 CARD READERS

A Card Reader System shall be supplied and installed by the following:
   1. Access Security Technology Inc. Steve Nettles (678) 627-0072
   2. Approved Equal

2.24 FABRICATION
A. Base Metals: Produce door hardware units of base metal, fabricated by forming method indicated, using manufacturer's standard metal alloy, composition, temper, and hardness. Furnish metals of a quality equal to or greater than that of specified door hardware units and BHMA A156.18 for finishes. Do not furnish manufacturer's standard materials or forming methods if different from specified standard.

B. Fasteners: Provide door hardware manufactured to comply with published templates generally prepared for machine, wood, and sheet metal screws. Provide screws according to commercially recognized industry standards for application intended. Provide Phillips flat-head screws with finished heads to match surface of door hardware, unless otherwise indicated.

1. Concealed Fasteners: For door hardware units that are exposed when door is closed, except for units already specified with concealed fasteners. Do not use through bolts for installation where bolt head or nut on opposite face is exposed unless it is the only means of securely attaching the door hardware. Where through bolts are used on hollow door and frame construction, provide sleeves for each through bolt.

2. Steel Machine or Wood Screws: For the following fire-rated applications:
   a. Mortise hinges to doors.
   b. Strike plates to frames.
   c. Closers to doors and frames.

3. Steel Through Bolts: For the following fire-rated applications, unless door blocking is provided:
   a. Closers to doors and frames.
   b. Surface-mounted exit devices.

4. Spacers or Sex Bolts: For through bolting of hollow metal doors.
5. Fasteners for Wood Doors: Comply with requirements of DHI WDHS.2, "Recommended Fasteners for Wood Doors."

2.25 FINISHES

A. Standard: Comply with BHMA A156.18.

B. Protect mechanical finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.

C. Appearance of Finished Work: Variations in appearance of abutting or adjacent pieces are acceptable if they are within one-half of the range of approved Samples. Noticeable variations in the same piece are not acceptable. Variations in appearance of other components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.
   1. Provide Architect with samples of Finishes for selection from standard .BHMA Designations.

PART 3 - EXECUTION
3.1 EXAMINATION

A. Examine doors and frames, with Installer present, for compliance with requirements for installation tolerances, labeled fire door assembly construction, wall and floor construction, and other conditions affecting performance of door hardware.

B. Examine roughing-in for electrical power systems to verify actual locations of wiring connections before electrified door hardware installation.

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

3.2 PREPARATION

A. Steel Doors and Frames: Comply with DHI A115 series, or ANSI/BHMA A156.115.

B. Wood Doors: Comply with DHI A115-W series, or ANSI/BHMA A156.115-W.

3.3 INSTALLATION

A. Mounting Heights: Mount door hardware units at heights indicated in following applicable publications, unless specifically indicated or required to comply with governing regulations:

1. Standard Steel Doors and Frames:
   a. DHI's "Recommended Locations for Architectural Hardware for Standard Steel Doors and Frames."
   b. ANSI "Hardware Preparation in Steel Doors and Steel Frames."

2. Custom Steel Doors and Frames: DHI's "Recommended Locations for Builders' Hardware for Custom Steel Doors and Frames."

3. Wood Doors:
   a. DHI WDHS.3, "Recommended Locations for Architectural Hardware for Wood Flush Doors."
   b. ANSI "Hardware Preparation in Wood Doors with Wood or Steel Frames."

B. Install each door hardware item to comply with manufacturer's written instructions. Where cutting and fitting are required to install door hardware onto or into surfaces that are later to be painted or finished in another way, coordinate removal, storage, and reinstallation of surface protective trim units with finishing work specified in Division 9 Sections. Do not install surface-mounted items until finishes have been completed on substrates involved.

1. Set units level, plumb, and true to line and location. Adjust and reinforce attachment substrates as necessary for proper installation and operation.

2. Drill and countersink units that are not factory prepared for anchorage fasteners. Space fasteners and anchors according to industry standards.

C. Key Control System: Place keys on markers and hooks in key control system cabinet, as determined by final keying schedule.

D. Thresholds: Set thresholds for exterior and acoustical doors in full bed of sealant complying with requirements specified in Division 7 Section "Joint Sealants."
3.4 FIELD QUALITY CONTROL

1. Independent Architectural Hardware Consultant will inspect door hardware and state in each report whether installed work complies with or deviates from requirements, including whether door hardware is properly installed and adjusted.

3.5 ADJUSTING

A. Initial Adjustment: Adjust and check each operating item of door hardware and each door to ensure proper operation or function of every unit. Replace units that cannot be adjusted to operate as intended. Adjust door control devices to compensate for final operation of heating and ventilating equipment and to comply with referenced accessibility requirements.
   1. Door Closers: Adjust sweep period so that, from an open position of 70 degrees, the door will take at least 3 seconds to move to a point 3 inches (75 mm) from the latch, measured to the leading edge of the door.

B. Six-Month Adjustment: Approximately six months after date of Substantial Completion, Installer shall perform the following:
   1. Examine and readjust each item of door hardware as necessary to ensure function of doors, door hardware, and electrified door hardware.
   2. Consult with and instruct Owner’s personnel on recommended maintenance procedures.
   3. Replace door hardware items that have deteriorated or failed due to faulty design, materials, or installation of door hardware units.

3.6 CLEANING AND PROTECTION

A. Clean adjacent surfaces soiled by door hardware installation.

B. Clean operating items as necessary to restore proper function and finish.

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

3.7 DEMONSTRATION

A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain door hardware and door hardware finishes.

3.8 DOOR HARDWARE SCHEDULE

A. Exposed finishes selected by Architect.

HW – 1
Door #'s: 11A Lobby (Aluminum /Glass, Swing Door), 2B Dining (Aluminum /Glass, Swing Door)

<table>
<thead>
<tr>
<th>Item</th>
<th>Finish</th>
</tr>
</thead>
<tbody>
<tr>
<td>Exit Device</td>
<td>Rim, Lever trim</td>
</tr>
<tr>
<td>Closure</td>
<td>Ramped type, fluted</td>
</tr>
<tr>
<td>Threshold</td>
<td></td>
</tr>
</tbody>
</table>
1 Weatherstripping pack
1 Pull

HW – 2
Door #’s: 10 Public Restroom (WD, Single), 6 Women (WD, Single), 5 Men (WD, Single)

3 Hinges (1 ½ pair) Antifriction bearing, full mortise, non-rising pin, heavy weight
1 Lockset (Privacy Lock) Cylindrical lock, Lock trim
1 Closure
1 Silencer pack

HW – 3
Door #’s: 11B Lobby (WD, Single), 9 Consultation (WD, Single), 12 Officer Office (WD, Single)

3 Hinges (1 ½ pair) Plain bearing, full mortise, standard weight
1 Lockset (Office Lock) Cylindrical lock, Lock trim
1 Closure w/hold open
1 Silencer pack

HW – 4
Door #’s: 13 Officer Bunk (WD, Single), 14 Bunk (WD, Single), 15 Bunk (WD, Single), 16 Bunk (WD, Single), 17 Bunk (WD, Single), 19 Bunk (WD, Single), 20 Bunk (WD, Single), 21 Bunk (WD, Single)

3 Hinges (1 ½ pair) Plain bearing, full mortise, standard weight
1 Lockset (Privacy Lock) Cylindrical lock, Lock Trim
1 Wall Bumper
1 Door Stop
1 Silencer pack

HW – 5
Door #’s: 22 Riser (HM, Single), 24 Elec / Mech (HM, Single)

3 Hinges (1 ½ pair) Antifriction bearing, full mortise, non-rising pin, heavy weight
1 Lockset (Storeroom Lock w/Dead bolt) Mortise lock, Lock Trim
1 Closure w/ hold open
1 Kick Plate 12” Bronze
1 Door Gasketing Rigid Head and Jamb
1 Door Gasketing Door Bottom
1 Threshold Ramped type, fluted
1 Metal Drip

HW – 6
Door #’s: 1A Engine Bay (HM, Single), 1D Engine Bay (HM, Single), 1E Engine Bay (HM, Single), 1H Engine Bay (HM, Single), 23B Corridor (HM, Single)

3 Hinges (1 ½ pair) Antifriction bearing, full mortise, non-rising pin, heavy weight
1 Exit Device Rim, Level Trim
1 Lockset (Punch Button) 5 button w/ key override
1 Closure w/ hold open
1 Kick Plate 12” Bronze
1 Door Gasketing Rigid Head and Jamb
1 Door Gasketing Door Bottom
DOORS AND WINDOWS

DIVISION 8

SECTION 08710

1 Threshold
1 Metal Drip

HW – 7
Door #’s: 2A Dining (HM, Single, UL Listed), 23A Corridor (HM, Single, UL Listed), 8 Laundry (HM, Single, UL Listed), 7A Locker (HM, Single, UL Listed)

3 Hinges (1 ½ pair) Antifriction bearing, full mortise, non-rising pin, heavy weight
1 Lockset (Punch Button) 5 button w/ key override
1 Closure w/ hold open
1 Kick Plate 12” Bronze
1 Door Gasketing Rigid Head and Jamb
1 Door Gasketing Door Sweep
1 Threshold Ramped type, fluted

HW – 8
Door #’s: 1B Engine Bay (Four-Fold), 1C Engine Bay (Four-Fold), 1F Engine Bay (Four-Fold), 1G Engine Bay (Four-Fold)
Hardware by door manufacturer per Section 08365.

HW – 9
Door #: 25 Janitor (WD, Single)

3 Hinges (1 ½ pair) Plain bearing, full mortise, standard weight
1 Lockset (Storeroom) Cylindrical lock, Lock trim
1 Closure w/hold open
1 Silencer pack

HW – 10
Door #: 23C Corridor (WD, Single)

3 Hinges (1 ½ pair) Antifriction bearing, full mortise, non-rising pin, heavy weight
1 Exit Device Rim, Level Trim
1 Lockset (Passage Latch) Cylindrical, Lock Trim
1 Closure w/ hold open
1 Kick Plate 12” Bronze

HW – 11
Door #: 1J Ice Machine (HM, Single)

3 Hinges (1 ½ pair) Antifriction bearing, full mortise, non-rising pin, heavy weight
1 Lockset (Passage Latch) Cylindrical lock, Lock trim
1 Silencer pack

HW – 12
Door #: 18 Multi-Purpose (WD, Pair)

6 Hinges (1 ½ pair) Plain bearing, full mortise, standard weight
2 Lockset (Passage Latch) Cylindrical lock, Lock Trim
1 Wall Bumper
2 Door Stop
2 Silencer pack
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 glazing for the following products, including those specified in other Sections where glazing requirements are specified by reference to this Section:
   1. Window units.
   2. Vision lites.
   3. Entrances and other doors.

B. Related Sections: The following sections contain requirements that relate to this Section.

1.3  DEFINITIONS

A. Manufacturer is used in this Section to refer to a firm that produces primary glass or fabricated glass as defined in the referenced glazing standard.

B. Deterioration of Insulating Glass: Failure of the hermetic seal under normal use due to causes other than glass breakage and improper practices for maintaining, and cleaning insulating glass. Evidence of failure is the obstruction of vision by dust, moisture, or film on the interior surfaces of glass. Improper practices for maintaining and cleaning glass do not comply with the manufacturer's directions.

1.4  SYSTEM PERFORMANCE REQUIREMENTS

A. General: Provide glazing systems that are produced, fabricated, and installed to withstand normal thermal movement, wind loading, and impact loading (where applicable), without failure including loss or glass breakage attributable to the following: defective manufacture, fabrication, and installation; failure of sealants or gaskets to remain watertight and airtight; deterioration of glazing materials; and other defects in construction.

B. Glass Design: Glass thicknesses indicated on Drawings are for detailing only. Confirm glass thicknesses by analyzing Project loads and in-service conditions. Provide glass lites for the various size openings in the thicknesses and strengths (annealed or heat-treated) to meet or exceed the following criteria:
   1. Minimum glass thickness, nominally, of lites in exterior walls is 6 mm.
   2. Tinted and heat-absorbing glass thicknesses for each tint indicated are the same throughout Project.
   3. Minimum glass thicknesses of lites, whether composed of annealed or heat-treated glass, are selected so the worst-case probability of failure does not exceed the following:
      a. 8 lites per 1000 for lites set vertically or not over 15 degrees off vertical and under wind action. Determine minimum thickness of monolithic annealed glass according to ASTM E 1300. For other than monolithic annealed glass, determine thickness per glass manufacturer's standard method of analysis including applying adjustment factors to ASTM E 1300 based on type of glass.
      b. 1 lite per 1000 for lites set over 15 degrees off vertical and under action of wind or snow.

C. Normal thermal movement results from the following maximum change (range) in ambient and surface temperatures acting on glass-framing members and glazing components. Base
engineering calculation on materials’ actual surface temperatures due to both solar heat gain and nighttime sky heat loss.

1. Temperature Change (Range): 120 F deg (67 C deg), ambient; 180 F deg (100 C deg), material surfaces.

D. Fire Rated Glass Units
1. Fire-rated clear and wireless glazing material for use in impact safety-rated locations such as doors, sidelites, transoms, borrowed lites and wall applications with fire rating requirements of 45 minutes to one hour; for use in interior or exterior applications. Consult manufacturer for exterior applications
2. Passes positive pressure test standards UL 10C, UBC 7-2, UBC 7-4.
3. Provides protection from radiant and conductive heat transfer.

1.5 SUBMITTALS

A. General: Submit the following according to Conditions of Contract and Division 1 Specification Sections.

B. Product data for each glass product and glazing material indicated.

C. Product certificates signed by glazing materials manufacturers certifying that their products comply with specified requirements.
   1. Separate certifications are not required for glazing materials bearing manufacturer's permanent labels designating type and thickness of glass, provided labels represent a quality control program of a recognized certification agency or independent testing agency acceptable to authorities having jurisdiction.

D. Compatibility and adhesion test reports from sealant manufacturer indicating that glazing materials were tested for compatibility and adhesion with glazing sealants. Include sealant manufacturer's interpretation of test results relative to sealant performance and recommendations for primers and substrate preparation needed for adhesion.

E. Compatibility test report from manufacturer of insulating glass edge sealant indicating that glass edge sealants were tested for compatibility with other glazing materials including sealants, glazing tape, gaskets, setting blocks, and edge blocks.

1.6 QUALITY ASSURANCE

A. Glazing Publications: Comply with published recommendations of glass product manufacturers and organizations below, except where more stringent requirements are indicated. Refer to these publications for glazing terms not otherwise defined in this Section or in referenced standards.
   1. FGMA Publications: "FGMA Glazing Manual."
   3. LSGA Publications: "LSGA Design Guide."

   1. Subject to compliance with requirements, provide safety glass permanently marked with certification label of Safety Glazing Certification Council (SGCC) or other certification agency acceptable to authorities having jurisdiction.
C. Insulating Glass Certification Program: Provide insulating glass units permanently marked either on spacers or at least one component lite of units with appropriate certification label of inspecting and testing agency indicated below:
   1. Insulating Glass Certification Council (IGCC).
   2. Associated Laboratories, Inc. (ALI).

D. Glazier Qualifications: Engage an experienced glazier who has completed glazing similar in material, design, and extent to that indicated for Project with a record of successful in-service performance.

E. Single-Source Responsibility for Glass: Obtain glass from one source for each product indicated below:
   1. Primary glass of each (ASTM C 1036) type and class indicated.
   2. Heat-treated glass of each (ASTM C 1048) condition indicated.
   3. Laminated glass of each (ASTM C 1172) kind indicated.
   4. Insulating glass of each construction indicated.

F. Single-Source Responsibility for Glazing Accessories: Obtain glazing accessories from one source for each product and installation method indicated.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Protect glazing materials to comply with manufacturer's directions and as needed to prevent damage to glass and glazing materials from condensation, temperature changes, direct exposure to sun, or other causes.
   1. Where insulating glass units will be exposed to substantial altitude changes, comply with insulating glass fabricator's recommendations for venting and sealing to avoid hermetic seal ruptures.

1.8 PROJECT CONDITIONS

A. Environmental Conditions: Do not proceed with glazing when ambient and substrate temperature conditions are outside the limits permitted by glazing materials manufacturer or when glazing channel substrates are wet from rain, frost, condensation, or other causes.
   1. Install liquid sealants at ambient and substrate temperatures above 40 deg F (4 deg C).

1.9 WARRANTY

A. General: Warranties specified in this Article shall not deprive the Owner of other rights the Owner may have under other provisions of the Contract Documents and will be in addition to and run concurrent with other warranties made by the Contractor under requirements of the Contract Documents.

B. Manufacturer's Warranty on Insulating Glass: Submit written warranty signed by manufacturer of insulating glass agreeing to furnish replacements for insulating glass units that deteriorate as defined in "Definitions" article, f.o.b. point of manufacture, freight allowed Project site, within specified warranty period indicated below. Warranty covers only deterioration due to normal conditions of use and not to handling, installing, protecting, and maintaining practices contrary to glass manufacturer's published instructions.
   1. Warranty Period: Manufacturer's standard but not less than 10 years after date of Substantial Completion.
PART 2 - PRODUCTS

2.1 PRIMARY FLOAT GLASS PRODUCTS

A. Float Glass: ASTM C 1036, Type I (transparent glass, flat), Class as indicated below, and Quality q3 (glazing select).
   1. Class 1 (clear) unless otherwise indicated.

B. Refer to requirements for sealed insulating glass units for performance characteristics of assembled units composed of tinted glass, coated or uncoated, relative to visible light transmittance, U-values, shading coefficient, and visible reflectance.

2.2 HEAT-TREATED FLOAT GLASS PRODUCTS, GENERAL

A. Fabrication Process: By horizontal (roller-hearth) process with roll-wave distortion parallel to bottom edge of glass as installed, unless otherwise indicated.

2.3 HEAT-TREATED FLOAT GLASS

A. Uncoated, Clear, Heat-Treated Float Glass: ASTM C 1048, Condition A (uncoated surfaces), Type I (transparent glass, flat), Class 1 (clear), Quality q3 (glazing select), kind as indicated below.
   2. Kind FT (fully tempered) where indicated.

B. Available Manufacturers: Subject to compliance with requirements, manufacturers offering heat-treated glass products that may be incorporated in the Work include, but are not limited to, the following companies.

C. Manufacturers: Subject to compliance with requirements, provide heat-treated glass by one of the following companies.
   1. AFG Industries, Inc.
   2. Cardinal IG.
   3. Guardian Industries Corp.
   4. PPG Industries, Inc.
   5. Spectrum Glass Products, Inc.
   6. GE

2.4 WIRED GLASS

A. Wired Glass: ASTM C 1036, Type II (patterned and wired glass, flat), Class 1 (clear), Quality q8 (glazing); 6.4 mm thick; of form and mesh pattern indicated below:
   1. Polished Wired Glass: Form 1 (wired, polished both sides), and as follows:
      a. Mesh m1 (diamond).
      b. Mesh m2 (square).
   2. Patterned Wired Glass: Form 2 (patterned and wired), Mesh m1 (diamond).

B. Available Manufacturers: Subject to compliance with requirements, manufacturers offering wired glass products that may be incorporated in the Work include, but are not limited to, the following companies.

C. Manufacturers: Subject to compliance with requirements, provide wired glass by one of the following companies.
   1. Polished Wired Glass:
      a. Ashai Glass Co.
      b. Central Glass Co., Ltd.
      c. Nippon Sheet Glass Ltd.
2.5  FIRE RATED GLASS PRODUCTS
A. Manufacturers: Subject to compliance with requirements manufacturers offering fire rated glass products that may be incorporated in the Work include, but are not limited to, the following companies.
   1. AGC InterEdge Technologies: Pyrobol series
   2. Pilkington: Pyrostop series
   3. Safti First: Superlite series
   4. Schott North America: Pyran series
   5. Technical Glass Products (TGP): Firelite series
   6. Vetrotech Saint-Gobain North America: Keralite series

B. Properties
   1. Thickness: Varies with rating and application (range from 5/8” to 2-1/8")
   2. Weight: Varies with thickness (approximate range 8 to 25 lbs./sq. ft.).
   3. Approximate Visible transmission: Varies with thickness. (Approximate range 85 to 71 percent).
   4. Fire Rating: 45 to 60 minutes
   6. Hose Steam tested
   7. Heat Resistant

C. Fire Rating: Fire Rating listed and labeled by UL for fire rating scheduled at opening locations in drawings, when tested in accordance with ASTM-E152 and ASTM E119

2.6  INSULATING GLASS PRODUCTS
A. Sealed Insulating Glass Units: Preassembled units consisting of organically sealed lites of glass separated by dehydrated air spaces complying with ASTM E 774 and with other requirements indicated.
   1. For properties of individual glass lites making up units, refer to requirements specified elsewhere in this Section applicable to types, classes, kinds, and conditions of glass products comprising lites of insulating glass units.
   2. Provide heat-treated, coated float glass of kind indicated or, if not otherwise indicated, Kind HS (heat strengthened) where recommended by manufacturer to comply with system performance requirements specified and Kind FT (fully tempered) where safety glass is designated or required.
   3. Performance characteristics designated for coated insulating glass are nominal values based on manufacturer's published test data for units with lites 6 mm thick and nominal 1/2-inch (13 mm) dehydrated space between lites, unless otherwise indicated.
   4. U-values are expressed as Btu/hr x sq. ft. x deg F (W/sq. m x K).
   5. Color: Provide samples for selection from a full range of manufacturers colors.
      a. Tinted units, uno.
      b. Clear units at fixed windows only.

2.7  HIGH REFLECTIVE COATED GLASS (ONE-WAY VISION GLASS)
A. Reflective Coated Glass units:
   1. Performance characteristics as follows:
      a. Glass Thickness: 1/4" / 6mm
      b. Glass Substrate: Grey
      c. Visible Transmittance: 11%
d. Visible Reflectance Coated Side: 68%
e. Visible Reflectance Glass Side: 16%

2. Locations: Storefront Entrance Doors. Other locations indicated on drawings.

B. Available Manufacturers: Subject to compliance with requirements, manufacturers offering reflective coated glass products that may be incorporated in the Work include, but are not limited to, the following companies.

C. Manufacturers: Subject to compliance with requirements, provide reflective coated glass by one of the following companies.
   1. Ashai Glass Co.
   2. Central Glass Co., Ltd.
   3. Nippon Sheet Glass Ltd.

2.8 ELASTOMERIC GLAZING SEALANTS

D. General: Provide products of type indicated, complying with the following requirements:
   1. Compatibility: Select glazing sealants and tapes of proven compatibility with other materials they will contact, including glass products, seals of insulating glass units, and glazing channel substrates, under conditions of installation and service, as demonstrated by testing and field experience.
   2. Suitability: Comply with sealant and glass manufacturer's recommendations for selecting glazing sealants and tapes that are suitable for applications indicated and conditions existing at time of installation.
   3. Colors: Provide color of exposed joint sealants to comply with the following:
      a. Provide selections made by Architect from manufacturer's full range of standard colors for products of type indicated.

E. Elastomeric Glazing Sealant Standard: Provide manufacturer's standard chemically curing, elastomeric sealants of base polymer indicated that comply with ASTM C 920 requirements.
   1. Additional Movement Capability: Where additional movement capability is specified, provide products, when tested for adhesion and cohesion under maximum cyclic movement per ASTM C19, with the capability to withstand the specified percentage change in the joint width existing at time of installation and remain in compliance with other requirements of ASTM C920 for uses indicated.

F. Glazing Sealant for Fire-Resistant Glazing Products: Identical to product used in test assembly to obtain fire-resistive rating.

2.9 GLAZING GASKETS

A. Lock-Strip Gaskets: Neoprene extrusions in size and shape indicated, fabricated into frames with molded corner units and zipper lock strips, complying with ASTM C542, black.

B. Dense Compression Gaskets: Molded or extruded gaskets of material indicated below, complying with standards referenced with name of elastomer indicated below, and of profile and hardness required to maintain watertight seal:
   2. EPDM, ASTM C 864.
   4. Thermoplastic polyolefin rubber, ASTM C 1115.

C. Soft Compression Gaskets: Extruded or molded closed-cell, integral-skinned gaskets of material indicated below, complying with ASTM C 509, Type II, black, and of profile and hardness required
to maintain watertight seal:
1. Neoprene.
2. EPDM.
4. Thermoplastic polyolefin rubber.

D. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated in the work include, but are not limited to, the following companies.

E. Manufacturers: Subject to compliance with requirements, provide products by one of the following companies.
1. Lock-Strip Gaskets:
2. Preformed Gaskets:
   a. Advanced Elastomer Systems, L.P.
   b. Schnee-Morehead, Inc.
   c. Tremco, Inc.

2.10 MISCELLANEOUS GLAZING MATERIALS

A. General: Provide products of material, size, and shape complying with referenced glazing standard, requirements of manufacturers of glass and other glazing materials involved for glazing application indicated, and with a proven record of compatibility with surfaces contacted in installation.

B. Cleaners, Primers and Sealers: Type recommended by sealant or gasket manufacturer.

C. Setting Blocks: Elastomeric material with a Shore A durometer hardness of 85 plus or minus 5.

D. Spacers: Elastomeric blocks or continuous extrusions with a Shore A durometer hardness required by glass manufacturer to maintain glass lites in place for installation indicated.

E. Edge Blocks: Elastomeric material of hardness needed to limit glass lateral movement (sidewalking).

F. Plastic Foam Joint Fillers: Preformed, compressible, resilient, nonstaining, nonextruding, nonoutgassing, strips of closed-cell plastic foam of density, size, and shape to control sealant depth and otherwise contribute to produce optimum sealant performance.

G. Perimeter Insulation for Fire-Resistive Glazing: Identical to product used in test assembly to obtain fire-resistive rating.

2.11 FABRICATION OF GLASS AND OTHER GLAZING PRODUCTS

A. Fabricate glass and other glazing products in sizes required to glaze openings indicated for Project, with edge and face clearances, edge and surface conditions, and bite complying with recommendations of product manufacturer and referenced glazing standard as required to comply with system performance requirements.

B. Clean cut or flat grind vertical edges of butt-glazed monolithic lites in a manner that produces square edges with slight kerfs at junctions with indoor and outdoor faces.

PART 3 - EXECUTION
3.1  EXAMINATION

A. Examine glass framing, with glazier present, for compliance with the following:
   1. Manufacturing and installation tolerances, including those for size, squareness, offsets at corners.
   2. Presence and functioning of weep system.
   3. Minimum required face or edge clearances.
   4. Effective sealing between joints of glass-framing members.

B. Do not proceed with glazing until unsatisfactory conditions have been corrected.

3.2  PREPARATION

A. Clean glazing channels and other framing members receiving glass immediately before glazing. Remove coatings that are not firmly bonded to substrates.

3.3  GLAZING, GENERAL

A. Comply with combined recommendations of manufacturers of glass, sealants, gaskets, and other glazing materials, except where more stringent requirements are indicated, including those in referenced glazing publications.

B. Glazing channel dimensions as indicated on Drawings provide necessary bite on glass, minimum edge and face clearances, and adequate sealant thicknesses, with reasonable tolerances. Adjust as required by Project conditions during installation.

C. Protect glass from edge damage during handling and installation as follows:
   1. Use a rolling block in rotating glass units to prevent damage to glass corners. Do not impact glass with metal framing. Use suction cups to shift glass units within openings; do not raise or drift glass with a pry bar. Rotate glass lites with flares or bevels on bottom horizontal edges so edges are located at top of opening, unless otherwise indicated by manufacturer's label.
   2. Remove damaged glass from Project site and legally dispose of off site. Damaged glass is glass with edge damage or other imperfections that, when installed, weaken glass and impair performance and appearance.

D. Apply primers to joint surfaces where required for adhesion of sealants, as determined by preconstruction sealant-substrate testing.

E. Install elastomeric setting blocks in sill rabbets, sized and located to comply with referenced glazing standard, unless otherwise required by glass manufacturer. Set blocks in thin course of compatible sealant suitable for heel bead.

F. Do not exceed edge pressures stipulated by glass manufacturers for installing glass lites.

G. Provide spacers for glass sizes larger than 50 united inches (1250 mm) (length plus height) as follows:
   1. Locate spacers inside, outside, and directly opposite each other. Install correct size and spacing to preserve required face clearances, except where gaskets and glazing tapes are used that have demonstrated ability to maintain required face clearances and comply with system performance requirements.
   2. Provide 1/8-inch (3 mm) minimum bite of spacers on glass and use thickness equal to sealant width. With glazing tape, use thickness slightly less than final compressed thickness of tape.
H. Provide edge blocking to comply with requirements of referenced glazing publications, unless otherwise required by glass manufacturer.

I. Set glass lites in each series with uniform pattern, draw, bow, and similar characteristics.

J. Where wedge-shaped gaskets are driven into one side of channel to pressurize sealant or gasket on opposite side, provide adequate anchorage so gasket cannot walk out when installation is subjected to movement.

K. Square cut wedge-shaped gaskets at corners and install gaskets in manner recommended by gasket manufacturer to prevent corners from pulling away; seal corner joints and butt joints with sealant recommended by gasket manufacturer.

3.4 GASKET GLAZING (DRY)

A. Fabricate compression gaskets in lengths recommended by gasket manufacturer to fit openings exactly, with stretch allowance during installation.

B. Secure compression gaskets in place with joints located at corners to compress gaskets producing a weathertight seal without developing bending stresses in glass. Seal gasket joints with sealant recommended by gasket manufacturer.

C. Install gaskets so they protrude past face of glazing stops.

3.5 SEALANT GLAZING (WET)

A. Install continuous spacers between glass lites and glazing stops to maintain glass face clearances and to prevent sealant from extruding into glass channel weep systems until sealants cure. Secure spacers in place and in position to control depth of installed sealant relative to edge clearance for optimum sealant performance.

B. Force sealants into glazing channels to eliminate voids and to ensure complete wetting or bond of sealant to glass and channel surfaces.

C. Tool exposed surfaces of sealants to provide a substantial wash away from glass. Install pressurized gaskets to protrude slightly out of channel to eliminate dirt and moisture pockets.

3.6 LOCK-STRIP GASKET GLAZING

A. Comply with ASTM C 716 and gasket manufacturer's printed recommendations. Provide supplementary wet seal and weep system unless otherwise indicated.

3.7 PROTECTION AND CLEANING

A. Protect exterior glass from breakage immediately after installation by attaching crossed streamers to framing held away from glass. Do not apply markers to glass surface. Remove nonpermanent labels, and clean surfaces.

B. Protect glass from contact with contaminating substances resulting from construction operations including weld splatter. If, despite such protection, contaminating substances do come into contact with glass, remove them immediately as recommended by glass manufacturer.

C. Examine glass surfaces adjacent to or below exterior concrete and other masonry surfaces at frequent intervals during construction, but not less than once a month, for build-up of dirt, scum,
alkali deposits, or stains, and remove as recommended by glass manufacturer.

D. Remove and replace glass that is broken, chipped, cracked, abraded, or damaged in any way, including natural causes, accidents and vandalism, during construction period.

E. Wash glass on both faces in each area of Project not more than 4 days prior to date scheduled for inspections that establish date of Substantial Completion. Wash glass as recommended by glass manufacturer.

END OF SECTION
PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Interior non load-bearing steel stud partition framing 20 gage and lighter (designed for 5 pounds per square foot uniform load perpendicular to partition).
   2. Gypsum board.

B. Related Sections:
   1. Section 05400 - Cold Formed Metal Framing: Load-bearing steel stud exterior and interior wall framing 20 gage and heavier and ceiling joists. Cold formed deep leg track for interior nonload-bearing steel stud partitions. Metal stud header wall framing and bracing supported from roof structure.
   2. Section 06100 - Rough Carpentry: Wood furring strips, plywood, blocking, and fasteners attached to partition framing.
   3. Section 07840 - Firestopping: Installation of firestopping at penetrations of fire-rated partitions.
   4. Section 09900 - Painting: Paint finish applied to gypsum board.

1.2 REFERENCES

A. The publications listed below form a part of this specification to the extent referenced. Publications are referenced within the text by the basic designation only.

B. ASTM International (ASTM):
   1. ASTM A 653 - Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.
   2. ASTM C475 - Joint Compound and Joint Tape for Finishing Gypsum Board.
   3. ASTM C 557 - Adhesives for Fastening Gypsum Wallboard to Wood Framing.
   4. ASTM C 645 - Nonstructural Steel Framing Members.
   5. ASTM C 754 - Installation of Steel Framing Members to Receive Screw-Attached Gypsum Panel Products.
   6. ASTM C 840 - Application And Finishing Of Gypsum Board.
   7. ASTM C 954 - Steel Drill Screws for the Application of Gypsum Board or Metal Plaster Bases to Steel Studs From 0.033 inches to 0.112 inches in Thickness.
   8. ASTM C 1002 - Steel Self-Piercing Tapping Screws For The Application Of Gypsum Panel Products Or Metal Plaster Bases To Wood Studs Or Steel Studs.
   9. ASTM C 1177 - Glass Mat Gypsum Substrate for Use as Sheathing.
  10. ASTM C 1178 - Coated Glass Mat Water-Resistant Gypsum Backing Panel.
  12. ASTM C 1396 - Gypsum Board.
  14. ASTM D 3274 - Standard Test Method for Evaluating Degree of Surface Disfigurement of Paint Films by Microbial (Fungal or Algal) Growth or Soil and Dirt Accumulation.

C. Gypsum Association (GA):
   2. GA-216 - Application and Finishing of Gypsum Board.

D. Steel Stud Manufacturer's Association (SSMA)
   1. Member listing
1.3 SUBMITTALS
A. Product Data: Provide product data for framing members.

1.4 QUALITY ASSURANCE
A. Installer Qualifications: Company specializing in the installation of light gage metal framing components and gypsum wallboard with minimum 5 years documented experience.

1.5 DELIVERY, STORAGE, AND HANDLING
A. Section 01600 - Product Requirements: Transport, handle, store, and protect products.
B. Protect metal framing from corrosion, deformation, and other damage during delivery, storage, and handling.
C. Store and protect metal framing with weatherproof covering, and ventilate to avoid condensation.
D. Deliver materials in original packages, containers, or bundles bearing brand name and identification of manufacturer or supplier.
E. Stack gypsum board flat to prevent sagging.

1.6 PROJECT CONDITIONS OR SITE CONDITIONS
A. Environmental Requirements:
   1. Establish and maintain environmental conditions for applying and finishing gypsum board in conformance with GA-216.

PART 2 - PRODUCTS
2.1 FRAMING MATERIALS
A. Manufacturer: Subject to compliance with requirements, provide products of one of the following:
   1. Dietrich Metal Framing.
   2. The Steel Network.
   3. Other manufacturers listed as a member of SSMA.
B. Recycled Content of Steel Products: Provide steel framing products with an average recycled content of steel products such that the postconsumer recycled content plus 1/2 of preconsumer recycled content is not less than 25 percent.
C. Interior Nonload-Bearing Partition Framing: ASTM C 645 and C 754; galvanized sheet steel, channel shaped, punched for utility access, depth and gages as indicated below unless otherwise indicated on Drawings.
   1. Partition having an unbraced length of 12 feet or Less: Minimum 25 gage (18 mil).
   2. Partition having an unbraced length greater than 12 Feet: Minimum 20 gage (30 mil).
   3. Partition (bulkheads) suspended from overhead having an unbraced length of 10 Feet or Less: Minimum 25 gage (18 mil).
   5. Partition height 8 - 16 feet: Minimum 22 gage (27 mil)
   6. Partition height 16 feet and higher: Minimum 20 gage (30 mil).
D. Option: Modified framing members of equivalent thickness for 20 and 25 gage metal such as

College Park Fire Station #3 - B1003-00
UltraSTEEL by Dietrich may be used in lieu of traditional framing members.

E. Partition Floor Tracks and Runners: ASTM C 645; galvanized sheet steel, channel shaped, same depth and gage as studs, tight fit; solid web.

F. Furring and Bracing: ASTM C 645; galvanized sheet steel.
   4. Cold-Rolled Channels: 3/4 x 1/2 inch and 1-1/2 x 17/32 inch, 16 gage (54 mil).
   6. Clip Angles: 2 inches x 2 inches x 16 gage (54 mil) x 1/4 inch less than stud width.
   7. Contractor’s Option: In lieu of cold rolled channels and clip angles for horizontal wall bridging, Contractor may provide one of the following:
      a. Bridge Bar by the Steel Network.
      b. TradeReady Spazzer 9200 Bridging and Bracing Bar by Dietrich Metal Framing

G. Ceiling Joists, Tracks, Headers at Partition Openings, Framing Attachment Angles, and Fasteners: Specified in Section 05400.

   1. 22 Gage (27 mil) Framing: ASTM C 1002; 3/8 inch Type S pan head.
   2. 20 Gage (30 mil) and Heavier Framing: ASTM C 954; 5/8 inch Type S-12 low-profile head.

I. Bracing to Framing Attachment Angle Fasteners: #12 diameter pan head corrosion-resistant self-drilling screws.

J. Partition Floor Track Anchorage Device: Low velocity powder-actuated drive pins; minimum 0.138 inch shank diameter x 1-1/2 inch shank length with 7/8 inch diameter washer.
   1. Hilti PAT System using X-ZF 37 P8S36 Pins, by Hilti, Tulsa, OK. (800) 879-8000.
   2. Ramset/Red Head System using 1500SD Pins, by ITW Ramset/Redhead, Wood Dale, IL (630) 350-0370.

2.2 GYPSUM BOARD MATERIALS

A. Manufacturer: United States Gypsum Company, Chicago, IL. (800) 874-4968.
   1. United States Gypsum (USG) gypsum wallboard designs are used within this Section to identify gypsum wallboard and accessory types, unless noted otherwise.
   2. Alternate Manufacturers: Subject to compliance with project requirements, unless otherwise specified, gypsum board and accessories equivalent to the USG products specified, by one of the following alternate manufacturers may be provided:
      a. CertainTeed Corp., Tampa, FL. (866) 427-2872.
      b. Georgia-Pacific, Atlanta, GA. (800) 284-5347.
      d. The Steel Network, Raleigh, NC (888) 474-4876. (Accessories only)
      e. Dietrich Metal Framing, Pittsburg, PA (412) 281-2805. (Accessories only)

B. Standard Gypsum Board: Sheetrock, ASTM C 1396; 1/2 inch and 5/8 inch thick, maximum permissible length; ends square cut, tapered edges.

C. Water Resistant Gypsum Board: ASTM C 1396 or C 1658, 1/2 inch thick, maximum permissible lengths; ends square cut, tapered edges. Mold resistance of water resistant gypsum board shall score a rating of not less than 10 when tested in accordance with ASTM D 3273. Provide the following:
1. Fiberock Brand Aqua-Tough Gypsum Interior Panels by USG

D. Fire Resistant Gypsum Board: Sheetrock Firecode Core, ASTM C 1396, Type X; 5/8 inch thick, maximum permissible lengths; ends square cut, tapered edges; core material as required to comply with Underwriters Laboratories (UL) assemblies indicated on Drawings.

E. Water and Fire Resistant Gypsum Board: Sheetrock Mold Tough Firecode “C” Core or Gold Bond Brand XP Fire-Shield C Gypsum Board, ASTM C 1396, Type X; 5/8 inch thick, maximum permissible lengths; ends square cut, tapered edges, core material as required to comply with Underwriters Laboratories (UL) assemblies indicated on Drawings. Mold resistance of water and fire resistant gypsum board shall score a rating of not less than 10 when tested in accordance with ASTM D 3273.

F. Abuse Resistant Gypsum Board: Panels meeting Soft Body Impact Resistance tested in accordance with ASTM E 696, level 2. 5/8 inch thick. Maximum permissible lengths; ends cut, tapered edges.

G. Gypsum Board Fasteners:
   1. Metal Framing: ASTM C 954 and C 1002, Type S-12 bugle head, corrosion-resistant self-drilling self-tapping steel screws.
   a. One Layer 1/2 Inch: 1 inch.

H. Wood Furring: ASTM C 1002, 1-1/4 inch, Type W bugle head, corrosion-resistant self-drilling steel screws.

I. Gypsum Board Accessories:
   2. Edge Trim: Galvanized steel casing.
      a. No. 200-B, L shape for tight abutment at edges.
      b. No. 200-A, J shape at other locations.
   7. Firestopping: Specified in Section 07840 for penetrations of fire-resistive rated gypsum board.

2.3 JOINT TREATMENT MATERIALS

A. General: Comply with ASTM C 475.

B. Joint Tape:
   1. Interior Gypsum Wallboard: Paper tape.

C. Joint Compound
   1. Interior Gypsum Wallboard: Sheetrock Ready-Mixed Lightweight All-Purpose Joint Compound with Dust Control.
      a. Substitutions not permitted.
   2. Exterior Applications:
      a. Exterior Gypsum Soffit Board: Use setting-type taping compound and setting-type, sandable topping compound.
      b. Gypsum Sheathing Board: As recommended by sheathing board manufacturer.
3. Backer Panels: Glass-Mat Backer Materials: Use setting-type taping compound as recommended by backer panel manufacturer and that is rated 10 when tested in accordance with ASTM D 3273 and evaluated in accordance with ASTM D 3274.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine existing conditions and adjacent areas where products will be installed and verify that conditions conform to product manufacturer's requirements. Verify that building framing components are ready to receive Work. Verify that rough-in utilities are in-place and located where required. Do not proceed until unsatisfactory conditions have been corrected.

B. Examine panels to assure they are dry and free of moisture and mold damage as evidenced by discoloration, sagging, irregular shape, fuzzy or splotchy surface contamination, and discoloration.

C. Beginning of erection and installation indicates acceptance of existing conditions.

3.2 INSTALLATION - STEEL FRAMING, GENERAL

A. Installation Standards: Comply with ASTM C 754, and ASTM C 840 requirements that apply to framing installation and with further details and instruction by gypsum board manufacturer's written construction guidelines.

B. Install supplementary framing, blocking, and bracing at terminations in gypsum board assemblies to support fixtures, equipment services, heavy trim, grab bars, toilet accessories, furnishings, or similar construction. Comply, if none available, with United States Gypsum's "Gypsum Construction Handbook."

3.3 INSTALLATION - PARTITION FRAMING

A. Install studs and fasteners in accordance with manufacturer's published instructions, ASTM C 754, GA-216, and GA-600.

B. Metal Stud Spacing: Unless otherwise noted, provide interior framing at maximum 24 inches on center. Provide 16 inches on center maximum spacing for walls to receive ceramic tile.

C. Align stud web openings horizontally.

D. Splice studs with minimum 8 inch nested lap, fasten each stud flange with minimum two screws.

E. Construct corners using minimum three studs.

F. Double stud at wall openings, door and window jambs, maximum 2 inches from each side of openings.

G. Place studs as indicated on Drawings, minimum 2 inches from abutting walls.

H. Install headers at partition openings using load-bearing C-shaped joists specified in Section 05400.

I. Install framing between studs for attachment of mechanical and electrical items.

J. Install intermediate studs above and below openings to match wall stud spacing.
K. Refer to Drawings for indication of partitions extending to finished ceiling only and for partitions extending through ceiling to building structure above.

L. Maintain clearance under structural members to avoid deflection transfer to studs.
   1. Where indicated, construct partition to accommodate vertical deflection.
   2. Install optional products by The Steel Network specified in Part 2 above in accordance with manufacturer's printed instruction.
      a. Install clip with step bushing in center of slotted hole.
      b. Use a minimum of two fasteners per clip leg to connect clip to structure and partition framing.
      c. Attach clip to each stud by screwing through the center of each step bushing.

M. Blocking: Screw attach wood blocking between studs. Install blocking for support of plumbing fixtures, toilet partitions, wall cabinets, toilet accessories and hardware.

N. Framing Fastening: Fasten framing in accordance with manufacturer's published instructions and schedule below, unless indicated otherwise on Drawings.

**CONNECTION**

<table>
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<tr>
<th>FASTENER</th>
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<tr>
<td>Floor Track to Concrete ..........</td>
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<td>Partition Stud to Floor Track ....</td>
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<td>Stud Brace Web to Stud Web ...</td>
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<td>Plates and Straps to Studs ...</td>
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<td>Stud Web to Stud Web ...</td>
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<td>Stud Brace Web to Attachment Angle ...</td>
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<tr>
<td>Lateral Bracing to Partition Stud Using clip Angles ...</td>
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<td>Runner to Header ...</td>
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3.4 **INSTALLATION - SUSPENDED CEILING**

A. Unless otherwise shown, install suspended ceilings in accordance with the following requirements.

B. Suspend ceiling hangers from building structure as follows:
   1. Install 1 1/2" cold rolled channels 4'-0" oc with 8 ga hanger wire spaced a max of 4'-0" oc along carrying channels. Attach 7/8" screw furring channels spaced 16" oc perpendicular to the 1 1/2" channel with double strand of saddle tied # 16 ga galvanized tie wire or 1 1/2" furring channel clips. Apply 1/2" gypsum board with its long dimension at right angles to the furring channels. Attach gypsum board with 1" self drilling drywall screws 12" oc in the field of the board 8" or 12" oc at butt joints, located not more than 1/2" from edges.
   2. Install hangers plumb and free from contact with insulation or other objects within ceiling plenum that are not part of supporting structural or ceiling suspension system. Splay hangers only where required to miss obstructions and offset resulting horizontal forces by bracing, countersplaying, or other equally effective means.
   3. Where width of ducts and other construction within ceiling plenum produces hanger spacing that interferes with the location of hangers required to support standard suspension system members, install supplemental suspension members and hangers in form of trapezes or equivalent devices. Size supplemental suspension members and hangers to support ceiling loads within performance limits established by referenced standards.
   4. Secure wire hangers by looping and wire-tying, either directly to structures or to inserts,
eyescrews, or other devices and fasteners that are secure and appropriate for substrate, and in a manner that will not cause them to deteriorate or otherwise fail.

5. Do not attach hangers to steel deck tabs.

6. Do not attach hangers to steel roof deck. Attach hangers to structural members.

7. Do not connect or suspend steel framing from ducts, pipes, or conduit.

C. Installation Tolerances: Install steel framing components for suspended ceilings so members for panel attachment are level to within 1/8 inch in 12 feet measured lengthwise on each member and transversely between parallel members.

3.5 INSTALLATION - FURRING

A. Furring Channels:
1. Attach vertically spaced at maximum 16 inches on center, to masonry and concrete surfaces with hammer set or powder driven fasteners staggered 24 inches on center on opposite flanges.
2. Nest channels 8 inches at splices and anchor with 2 fasteners in each wing.

B. Wall Furring:
1. Secure top and bottom runners to structure.
2. Space metal studs at maximum 16 inches on center.
3. Furring for Fire Rating: Install metal furring as required for fire resistance ratings indicated on Drawings, and to GA-600 requirements.

3.6 ACOUSTICAL ACCESSORIES INSTALLATION

A. Place acoustical insulation in partitions tight within spaces, around cut openings, behind and around electrical and mechanical items within or behind partitions, and tight to items passing through partitions as specified in Section 07210.

3.7 INSTALLATION - GYPSUM BOARD

A. Install gypsum board in accordance with manufacturer's published instructions, ASTM C 840, GA-216, and GA-600.
1. Use water resistant gypsum board at wet areas including walls and ceiling in toilet rooms, janitor closets, and food prep areas as applicable and where shown.
2. Use fire resistant gypsum board at locations of fire-resistive rated assemblies indicated on Drawings.
3. Use water and fire resistant gypsum board at locations of fire-resistive rated assemblies where water resistant gypsum board is specified.
4. Use standard gypsum board at locations not indicated to be fire resistant or water resistant type.

B. Where applicable, install ceiling panels before the installation of wall panels.

C. Erect single layer gypsum board in most economical direction, with attachment to firm bearing surfaces over framing members. Do not align panel joints with edges of openings.

D. Treat cut edges, holes, fastener heads, and joints, including those at angle intersections, in water resistant gypsum board and exterior gypsum soffit board with specified joint compound. Treat prior to installation.

E. Place gypsum panels over supporting framing members with panel ends aligning and parallel with framing members. Leave approximately 1/2 inch gap above floor to prevent water and moisture from wicking up gypsum board.

F. Install fasteners from center of field of panel toward ends and edges. Install fasteners 3/8 inch
from ends and edges of panels, and as follows:
1. Ceiling: 12 inches on center, perimeter and field.
2. Walls:
   a. Standard: 16 inches on center, perimeter and field.
   b. Water-Resistant: 12 inches on center, perimeter and field.

3.8 JOINT TREATMENT
A. Reinforce interior and exterior corners at ceiling and wall surfaces. Apply 3 inch wide initial coating of joint compound, pressing tape firmly into joint compound. Wipe off excess joint compound. Apply second coat of joint compound with tools of sufficient width to extend beyond joint center, approximately 4 inches. Draw joint compound down to a smooth even plane.
B. After drying or setting, sand or sponge joints, edges, and corners, eliminating high spots and excessive joint compound to produce smooth finish surface. Prepare surfaces to receive subsequent finishes to height of 6 inches above finish ceiling. Feather coats onto adjoining surfaces resulting in maximum camber of 1/32-inch in 12.
C. Sand after second and third applications of joint compound. Do not raise nap of paper when sanding.
D. Install control joints full height of partition with 1/2 inch gap between board edges and between studs. Control joints shall be installed in accordance with the Gypsum Association GA-234 or the gypsum manufacturer's recommended guidelines for control joints. Apply sealant at base of joint and control joint accessory piece at face. Install control joints at the following locations:
   1. Where a wall or partition runs in an uninterrupted straight plane exceeding 30 linear feet.
   2. At pairs of doors, install vertical control joint at each jamb. At single doors, install control joint at latch side of jamb.
E. Place corner beads at external corners. Use longest practical length. Place edge trim where gypsum board abuts dissimilar materials.

3.9 FINISH
A. Apply gypsum board finish in accordance with manufacturer's published instructions and GA-214 Finish Levels.
B. Provide gypsum board finish levels as follows:
   1. Level 3 (GA-214): Joints and interior angles have tape embedded in joint compound and one additional coat of joint compound applied over all joints and interior angles and two separate coats of joint compound are applied over joints, angles, fastener heads, and accessories. Surface smooth and free of tool marks and ridges.
   2. Level 3: Joints and interior angles have tape embedded in joint compound and two separate coats of joint compound applied over joints, angles, fastener heads, and accessories. Surface smooth and free of tool marks and ridges.

3.10 CONSTRUCTION
A. Interface with Other Work:
   1. Coordinate erection of studs with hollow metal door and window frames, sliding window, and overhead coiling door frames.
   2. Coordinate installation of anchors, supports, and blocking for mechanical, electrical, and building accessory items installed within framing.

3.11 FIELD QUALITY CONTROL
A. Inspect metal framing erection, placement, spacing, fasteners, and connections to building.

B. Inspect gypsum board installation, fastener type, spacing, and finish level.

C. Inspect installation of firestopping penetrations of fire-restive rated partitions and at voids between top of partition and building structure.

D. Correct deficiencies in Work which inspection indicates are not in compliance with Contract Documents.

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 1 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes the following:
   1. Glazed Ceramic wall tile.
   2. Porcelain floor tiles
   3. Stone thresholds installed as part of tile installations.

B. Related Sections include the following:
   1. Division 3 Section "Cast-in-Place Concrete" for monolithic slab finishes specified for tile substrates.
   2. Division 7 Section "Joint Sealants" for sealing of expansion, contraction, control, and isolation joints in tile surfaces.
   3. Division 9 Section "Gypsum Board" for cementitious backer units installed in gypsum wallboard assemblies.

1.3 DEFINITIONS

A. Module Size: Actual tile size (minor facial dimension as measured per ASTM C 499) plus joint width indicated.

B. Facial Dimension: Actual tile size (minor facial dimension as measured per ASTM C 499).

C. Facial Dimension: Nominal tile size as defined in ANSI A137.1.

1.4 PERFORMANCE REQUIREMENTS

A. Static Coefficient of Friction: For tile installed on walkway surfaces, provide products with the following values as determined by testing identical products per ASTM C 1028:
   1. Level Surfaces: Minimum 0.6.

1.5 SUBMITTALS

A. Product Data: For each type of tile, mortar, grout, and other products specified.

B. Shop Drawings: For the following:
   1. Tile patterns and locations.
   2. Widths, details, and locations of expansion, contraction, control, and isolation joints in tile substrates and finished tile surfaces.

C. Tile Samples for Initial Selection: Manufacturer's color charts consisting of actual tiles or sections of tiles showing the full range of colors, textures, and patterns available for each type and composition of tile indicated. Include Samples of accessories involving color selection.

D. Grout Samples for Initial Selection: Manufacturer's color charts consisting of actual sections of grout showing the full range of colors available for each type of grout indicated.
FINISHES CERAMIC TILE
DIVISION 9 SECTION 09310

E. Samples for Verification: Of each item listed below, prepared on Samples of size and construction indicated. Where products involve normal color and texture variations, include Sample sets showing the full range of variations expected.
1. Each type and composition of tile and for each color and texture required, at least 12 inches (300 mm) square, mounted on braced cementitious backer units, and with grouted joints using product complying with specified requirements and approved for completed work in color or colors selected by Architect.
2. Full-size units of each type of trim and accessory for each color required.
3. Stone thresholds in 6-inch (150-mm) lengths.

F. Master Grade Certificates: For each shipment, type, and composition of tile, signed by tile manufacturer and Installer.

G. Product Certificates: Signed by manufacturers certifying that the products furnished comply with requirements.

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

1.6 QUALITY ASSURANCE

A. Installer Qualifications: Engage an experienced installer who has completed tile installations similar in material, design, and extent to that indicated for this Project and with a record of successful in-service performance.

B. Source Limitations for Tile: Obtain each color, grade, finish, type, composition, and variety of tile from one source with resources to provide products from the same production run for each contiguous area of consistent quality in appearance and physical properties without delaying the Work.

C. Source Limitations for Setting and Grouting Materials: Obtain ingredients of a uniform quality for each mortar, adhesive, and grout component from a single manufacturer and each aggregate from one source or producer.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Deliver and store packaged materials in original containers with seals unbroken and labels intact until time of use. Comply with requirement of ANSI A137.1 for labeling sealed tile packages.

B. Prevent damage or contamination to materials by water, freezing, foreign matter, and other causes.

C. Handle tile with temporary protective coating on exposed surfaces to prevent coated surfaces from contacting backs or edges of other units. If coating does contact bonding surfaces of tile, remove coating from bonding surfaces before setting tile.

1.8 PROJECT CONDITIONS

A. Environmental Limitations: Do not install tile until construction in spaces is completed and ambient temperature and humidity conditions are being maintained to comply with referenced standards and manufacturer's written instructions.
FINISHES CERAMIC TILE
DIVISION 9 SECTION 09310

1.9 EXTRA MATERIALS

A. Deliver extra materials to Owner. Furnish extra materials described below that match products installed, are packaged with protective covering for storage, and are identified with labels describing contents.
   1. Tile and Trim Units: Furnish quantity of full-size units equal to 5 percent of amount installed, for each type, composition, color, pattern, and size indicated.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, those indicated in the ceramic tile installation schedules at the end of this Section.

B. Products: Subject to compliance with requirements, provide products indicated in the ceramic tile installation schedules at the end of this Section.

C. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

D. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   1. Tile Products:
      b. Crossville Ceramics.
      c. Dal-Tile Corporation.
      d. GranitiFiandre.
      e. Quamagra
      f. Cerzmica Vaccari
      g. Niro
   2. Tile-Setting and -Grouting Materials:
      b. Dal-Tile Corporation

2.2 PRODUCTS, GENERAL

A. ANSI Ceramic Tile Standard: Provide tile that complies with ANSI A137.1, "Specifications for Porcelain and Ceramic Tile," for types, compositions, and other characteristics indicated.
   1. Provide tile complying with Standard Grade requirements, unless otherwise indicated.
   2. For facial dimensions of tile, comply with requirements relating to tile sizes specified in Part 1 "Definitions" Article.


C. Colors, Textures, and Patterns: Where manufacturer's standard products are indicated for tile, grout, and other products requiring selection of colors, surface textures, patterns, and other appearance characteristics, provide specific products or materials complying with the following requirements:
   1. Provide Architect's selections from manufacturer's full range of colors, textures, and patterns for products of type indicated.
D. Factory Blending: For tile exhibiting color variations within the ranges selected during Sample submittals, blend tile in the factory and package so tile units taken from one package show the same range in colors as those taken from other packages and match approved Samples.

E. Mounting: Where factory-mounted tile is required, provide back- or edge-mounted tile assemblies as standard with manufacturer, unless another mounting method is indicated.
   1. Where tile is indicated for installation in swimming pools, on exteriors, or in wet areas, do not use back- or edge-mounted tile assemblies unless tile manufacturer specifies in writing that this type of mounting is suitable for these kinds of installations and has a record of successful in-service performance.

F. Factory-Applied Temporary Protective Coating: Where indicated under tile type, protect exposed surfaces of tile against adherence of mortar and grout by precoating them with a continuous film of petroleum paraffin wax, applied hot. Do not coat unexposed tile surfaces.

2.3 TILE PRODUCTS

A. Porcelain Floor Tile: Provide square-edged flat tile complying with the following requirements:
   2. Facial Dimensions: Selected and approved by Architect from the options below. Final sizes will be determined after receipt and review of the samples per submittals in Part 1 above.
      a. 12" x 12" (304.8mm by 304.8 mm).
      b. 6" x 6" (152.4mm by 152.4mm).
   3. Thickness: 3/8 inch (9.5 mm).
   4. Face: Pattern of design indicated.

B. Glazed Wall Tile: Provide flat tile complying with the following requirements:
   1. Module Size: Selected and approved by Architect from the options below. Final sizes will be determined after receipt and review of the samples per submittals in Part 1 above.
      a. 12" x 12" (304.8mm by 304.8 mm).
      b. 6" x 6" (152.4mm by 152.4mm).
      c. 4-1/4 by 4-1/4 inches (114.3 by 114.3 mm).
   2. Thickness: 5/16 inch (8 mm).
   3. Face: Plain with modified square edges or cushion edges.

C. Trim Units: Provide tile trim units to match characteristics of adjoining flat tile and to comply with the following requirements:
   1. Size: Available sizes per manufacturer’s standards, coordinated with sizes and coursing of adjoining flat tile where applicable.
   2. Shapes: As follows, selected from manufacturer’s standard shapes:

2.4 STONE THRESHOLDS

A. General: Provide stone thresholds that are uniform in color and finish, fabricated to sizes and profiles indicated to provide transition between tile surfaces and adjoining finished floor surfaces.
   1. Fabricate thresholds to heights indicated, but not more than 1/2 inch (12.7 mm) above adjoining finished floor surfaces, with transition edges beveled on a slope of no greater than 1:2.

B. Marble Thresholds: Provide marble thresholds complying with ASTM C 503 requirements for
1. Provide white, honed marble complying with the Marble Institute of America’s Group A requirements for soundness.

2.5 WATERPROOFING FOR THIN-SET TILE INSTALLATIONS

A. General: Provide products that comply with ANSI A118.10 and the descriptions in this Article.

B. Urethane Waterproofing and Tile-Setting Adhesive: Manufacturer’s standard proprietary product consisting of 1-part liquid-applied urethane in a consistency suitable for trowel application and intended for use as both waterproofing and tile-setting adhesive in a 2-step process.

C. Available Products: Subject to compliance with requirements, products which may be incorporated into the Work include, but are not limited to, the following:

2.6 SETTING MATERIALS

A. Portland Cement Mortar Installation Materials: Provide materials complying with ANSI A108.1A and as specified below:

1. Cleavage Membrane: Asphalt felt, ASTM D 226, Type I (No. 15), or polyethylene sheeting ASTM D 4397, 4.0 mils (0.1 mm) thick.

2. Reinforcing Wire Fabric: Galvanized, welded wire fabric, 2 by 2 inches (50.8 by 50.8 mm) by 0.062-inch (1.57-mm) diameter; comply with ASTM A 185 and ASTM A 82, except for minimum wire size.

3. Expanded Metal Lath: Provide diamond-mesh lath complying with ASTM C 847 for requirements indicated below:
   a. Base Metal and Finish for Interior Applications: Fabricate lath from uncoated or zinc-coated (galvanized) steel sheet, with uncoated steel sheet painted after fabrication into lath.
   c. Configuration over Studs and Furring: Flat.
   e. Weight: 2.5 lb/sq. yd. (1.4 kg/sq. m).
   f. Weight: 3.4 lb/sq. yd. (1.8 kg/sq. m).

4. Latex additive (water emulsion) described below, serving as replacement for part or all of gaging water, of type specifically recommended by latex additive manufacturer for use with job-mixed portland cement and aggregate mortar bed.
   a. Latex Additive: Manufacturer’s standard.
   b. Latex Additive: Styrene butadiene rubber.
   c. Latex Additive: Acrylic resin.

2.7 GROUTING MATERIALS

A. Commercial Portland Cement Grout (Sanded Grout): ANSI A118.6, color as indicated, for joints 1/8 inch (3.2 mm) or wider.

2.8 ELASTOMERIC SEALANTS

A. General: Provide manufacturer’s standard chemically curing, elastomeric sealants of base polymer and characteristics indicated that comply with applicable requirements of Division 7 Section "Joint Sealants."
B. Colors: Provide colors of exposed sealants to match colors of grout in tile adjoining sealed joints, unless otherwise indicated.

C. One-Part, Mildew-Resistant Silicone Sealant: ASTM C 920; Type S; Grade NS; Class 25; Uses NT, G, A, and, as applicable to nonporous joint substrates indicated, O; formulated with fungicide, intended for sealing interior ceramic tile joints and other nonporous substrates that are subject to in-service exposures of high humidity and temperature extremes.

2.9 MISCELLANEOUS MATERIALS

A. Trowelable Underlayments and Patching Compounds: Latex-modified, portland-cement-based formulation provided or approved by manufacturer of tile-setting materials for installations indicated.

B. Metal Edge Strips: White-zinc-alloy terrazzo strips, 1/8 inch (3.2 mm) wide at top edge with integral provision for anchorage to mortar bed or substrate, unless otherwise indicated.

C. Temporary Protective Coating: Provide product indicated below that is formulated to protect exposed surfaces of tile against adherence of mortar and grout; is compatible with tile, mortar, and grout products; and is easily removable after grouting is completed without damaging grout or tile.
   1. Petroleum paraffin wax, fully refined and odorless, containing at least 0.5 percent oil with a melting point of 120 to 140 deg F (49 to 60 deg C) per ASTM D 87.
   2. Grout release in form of manufacturer's standard proprietary liquid coating that is specially formulated and recommended for use as a temporary protective coating for tile.

D. Tile Cleaner: A neutral cleaner capable of removing soil and residue without harming tile and grout surfaces, specifically approved for materials and installations indicated by tile and grout manufacturers.

2.10 MIXING MORTARS AND GROUT

A. Mix mortars and grouts to comply with referenced standards and mortar and grout manufacturers’ written instructions.

B. Add materials, water, and additives in accurate proportions.

C. Obtain and use type of mixing equipment, mixer speeds, mixing containers, mixing time, and other procedures to produce mortars and grouts of uniform quality with optimum performance characteristics for installations indicated.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions where tile will be installed, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of installed tile.

   1. Verify that substrates for setting tile are firm; dry; clean; free from oil, waxy films, and curing compounds; and within flatness tolerances required by referenced ANSI A108 series of tile installation standards for installations indicated.
   2. Verify that installation of grounds, anchors, recessed frames, electrical and mechanical
3. Verify that joints and cracks in tile substrates are coordinated with tile joint locations; if not coordinated, adjust latter in consultation with Architect.

B. Do not proceed with installation until unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Remove coatings, including curing compounds, and other substances that contain soap, wax, oil, or silicone and are incompatible with tile-setting materials by using a terrazzo or concrete grinder, a drum sander, or a polishing machine equipped with a heavy-duty wire brush.

B. Provide concrete substrates for tile floors installed with dry-set or latex-Portland cement mortars that comply with flatness tolerances specified in referenced ANSI A108 series of tile installation standards for installations indicated.
   1. Use trowelable leveling and patching compounds per tile-setting material manufacturer's written instructions to fill cracks, holes, and depressions.
   2. Remove protrusions, bumps, and ridges by sanding or grinding.

C. Blending: For tile exhibiting color variations within the ranges selected during Sample submittals, verify that tile has been blended in the factory and packaged so tile units taken from one package show the same range in colors as those taken from other packages and match approved Samples. If not factory blended, either return to manufacturer or blend tiles at Project site before installing.

D. Field-Applied Temporary Protective Coating: Where indicated under tile type or needed to prevent adhesion or staining of exposed tile surfaces by grout, protect exposed surfaces of tile against adherence of mortar and grout by precoating them with a continuous film of temporary protective coating indicated below, taking care not to coat unexposed tile surfaces:
   1. Petroleum paraffin wax, applied hot.
   2. Grout release.
   3. Petroleum paraffin wax or grout release.

3.3 INSTALLATION, GENERAL

A. ANSI Tile Installation Standards: Comply with parts of ANSI A108 series of tile installation standards in "Specifications for Installation of Ceramic Tile" that apply to types of setting and grouting materials and to methods indicated in ceramic tile installation schedules.


C. Extend tile work into recesses and under or behind equipment and fixtures to form a complete covering without interruptions, unless otherwise indicated. Terminate work neatly at obstructions, edges, and corners without disrupting pattern or joint alignments.

D. Accurately form intersections and returns. Perform cutting and drilling of tile without marring visible surfaces. Carefully grind cut edges of tile abutting trim, finish, or built-in items for straight aligned joints. Fit tile closely to electrical outlets, piping, fixtures, and other penetrations so plates, collars, or covers overlap tile.

E. Jointing Pattern: Lay tile in grid pattern, unless otherwise indicated. Align joints when adjoining
tiles on floor, base, walls, and trim are the same size. Lay out tile work and center tile fields in both directions in each space or on each wall area. Adjust to minimize tile cutting. Provide uniform joint widths, unless otherwise indicated.

1. For tile mounted in sheets, make joints between tile sheets the same width as joints within tile sheets so joints between sheets are not apparent in finished work.

F. Expansion Joints: Locate expansion joints and other sealant-filled joints, including control, contraction, and isolation joints, where indicated during installation of setting materials, mortar beds, and tile. Do not saw-cut joints after installing tiles.

2. Locate joints in tile surfaces directly above joints in concrete substrates.

3. Prepare joints and apply sealants to comply with requirements of Division 7 Section "Joint Sealants."

G. Grout tile to comply with the requirements of the following tile installation standards:

1. For ceramic tile grouts (sand-portland cement, dry-set, commercial portland cement, and latex-portland cement grouts), comply with ANSI A108.10.

F. At showers, tubs, and where indicated, install cementitious backer units and treat joints to comply with ANSI A108.11 and manufacturer’s written instructions for type of application indicated.

3.4 WATERPROOFING INSTALLATION

A. Install waterproofing to comply with waterproofing manufacturer’s written instructions to produce a waterproof membrane of uniform thickness bonded securely to substrate.

3.5 FLOOR TILE INSTALLATION

A. General: Install tile to comply with requirements in the Ceramic Tile Floor Installation Schedule, including those referencing TCA installation methods and ANSI A108 series of tile installation standards.

B. Joint Widths: Install tile on floors with the following joint widths:

1. Porcelain Tile: 1/4 inch (6.35 mm).

C. Back Buttering: For installations indicated, obtain 100 percent mortar coverage by complying with applicable special requirements for back buttering of tile in referenced ANSI A108 series of tile installation standards:

1. Tile floors in wet areas, including showers.
2. Tile floors composed of tiles 8 by 8 inches (203 by 203 mm) or larger.
3. Tile floors composed of rib-backed tiles.

D. Stone Thresholds: Install stone thresholds at locations indicated; set in same type of setting bed as abutting field tile, unless otherwise indicated.

1. Set thresholds in latex-portland cement mortar for locations where mortar bed would otherwise be exposed above adjacent nontile floor finish.

3.6 WALL TILE INSTALLATION

A. Install types of tile designated for wall installations to comply with requirements in the Ceramic Tile Wall Installation Schedule, including those referencing TCA installation methods and ANSI setting-bed standards.

B. Install metal lath and scratch coat to walls to comply with ANSI A108.1A, Section 4.1.
C. Joint Widths: Install tile on walls with the following joint widths:
   2. Ceramic Mosaic Tile: 1/8 inch (1.6 mm).
   3. Wall Tile: 1/8 inch (1.6 mm).

D. Back Buttering: For installations indicated, obtain 100 percent mortar coverage by complying with applicable special requirements for back buttering of tile in referenced ANSI A108 series of tile installation standards:
   1. Tile wall installations in wet areas, including showers, tub enclosures, laundries, and swimming pools.

3.7 CLEANING AND PROTECTING

A. Cleaning: On completion of placement and grouting, clean all ceramic tile surfaces so they are free of foreign matter.
   1. Remove latex-portland cement grout residue from tile as soon as possible.
   2. Unglazed tile may be cleaned with acid solutions only when permitted by tile and grout manufacturer's written instructions, but no sooner than 10 days after installation. Protect metal surfaces, cast iron, and vitreous plumbing fixtures from effects of acid cleaning. Flush surface with clean water before and after cleaning.
   3. Remove temporary protective coating by method recommended by coating manufacturer that is acceptable to brick and grout manufacturer. Trap and remove coating to prevent it from clogging drains.

B. Finished Tile Work: Leave finished installation clean and free of cracked, chipped, broken, unbonded, and otherwise defective tile work.

C. Provide final protection and maintain conditions, in a manner acceptable to manufacturer and Installer, that ensure tile is without damage or deterioration at the time of Substantial Completion.
   1. When recommended by tile manufacturer, apply a protective coat of neutral protective cleaner to completed tile walls and floors. Protect installed tile work with kraft paper or other heavy covering during construction period to prevent staining, damage, and wear.
   2. Prohibit foot and wheel traffic from tiled floors for at least 7 days after grouting is completed.

D. Before final inspection, remove protective coverings and rinse neutral cleaner from tile surfaces.

END OF SECTION
PART 1 - GENERAL

1.1 SUMMARY:

A. Work of this section includes installation of two types of epoxy flooring with integral base where indicated on drawings.

1.2 SUBMITTALS:

A. Product data: Submit manufacturer's data and application instructions. Include statement that installed flooring will comply with non-slip properties specified.

B. Samples: Submit 6" by 6" samples for Architect's selection showing non-slip finish and manufacturer's standard colors, applied to rigid backing.

1. For initial selection of colors and finishes, submit manufacturer's color charts showing full range of colors and finishes available.

C. Manufacturer's detailed maintenance and care instructions.

1.3 QUALITY ASSURANCE:

A. Applicable standards; standards of the following, as referenced herein:


B. Installer and manufacturer qualifications:

1. Installer: Trained and approved in writing by flooring system manufacturer.
2. Manufacturer: Minimum five years of production and installation of specified system.

C. Pre-Installation Conference:

1. General contractor shall arrange a meeting not less than thirty days prior to starting work.
2. Attendance:
   a. General Contractor.
   b. Architect.
   c. Manufacturer / Installer Representative.

1.4 DELIVERY, STORAGE AND HANDLING:

A. Deliver materials to project site in manufacturer's unopened

B. All materials used shall be factory pre-weighed and pre-containers with labels intact packaged in single, easy to manage batches to eliminate on site mixing errors. No on site weighting 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 between 60 and 85 degree F/16 and 30 degree C.

D. Store materials indoors; protect from contamination.

1.5 PROJECT/SITE CONDITIONS:

A. Environmental requirements: Work of other trades shall be complete in installation area, to eliminate dust, dirt, damage or other deleterious conditions during installation of flooring. Maintain temperature before, during and after installation until flooring is cured, at a temperature range as recommended by flooring manufacturer's product data.

B. Provide controlled ventilation in spaces being floored. Maintain ventilation throughout curing period.

C. Coordination: Coordinate requirements for special finishing and curing of concrete floor slabs with requirements of Division 3, minimum of 30 days.

D. Job area to be free of other trades during, and for a period of 24 hours, after floor installation.

1.6 WARRANTIES:

A. Installer and flooring manufacturer shall jointly warranty flooring material and application for a period of three years, for its normal and intended use; should flooring need repair or replacement, Owner will incur no cost for repair or replacement. Warranty shall begin on Date of Substantial Completion.

PART 2 - PRODUCTS

2.1 DECORATIVE SEAMLESS EPOXY FLOORING:

A. Acceptable manufacturers, subject to compliance with specified requirements:
   2. Stonhard, Inc.
   3. Dexotex, Div. of Crossfield Products Corp.
   4. General Polymers Corp.
   5. Selby, Div. of Degussa Building Systems.
   6. Tnemec Co., Inc.

B. Characteristics:
   1. Type: Self-leveling epoxy floor system consisting of a penetrating membrane bodycoat primer, colored quartz silica aggregate, and clear epoxy grout coat sealer topcoat; with integral base.
   2. Thickness: 1/8" (125 mils).
   3. Integral base: 8" high base.
   4. Colors: Two bright colors, as selected by Architect from manufacturer's standard colors.

C. Physical properties:
   1. Flammability: Self extinguishing hen tested in accord with ASTM D635-98, extent of burning 0.25 inches maximum.
2. Hardness: 83 average when tested in accord with ASTM D2240-02b, Shore D.
3. Water absorption: 0.37% when tested in accord with ASTM C413-01.
4. Abrasion resistance: 0.05 gm maximum weight loss when tested in accord with ASTM D4060-01, taber abrader CS-17 wheel.
5. Impact resistance: Maximum 10 Mil without cracking, delamination or chipping when tested in accord with MIL-D3134.
6. Compressive strength: 13,500 psi minimum when tested in accord with ASTM 579-01.
9. Coefficient of friction: 0.89 when tested in accord with ASTM D2047-99.
10. Thermal coefficient of expansion: 1.9 x 10^(-6) when tested in accord with ASTM 531-00, in/in/degree C.
11. Bond strength: >535 psi when tested in accord with ASTM D4541-02 (100% concrete failure).
13. Cure rate: Allow 16 hours for light traffic, and 24

D. Accessory materials: Provide primers, sealers and other accessories as required.

PART 3 - EXECUTION

3.1 EXAMINATION:
A. Perform bond and moisture tests on subfloors in accord with ASTM F2170-02 and epoxy flooring manufacturer's product data to determine if surfaces are acceptable to receive specified epoxy flooring products. Correct conditions detrimental to epoxy flooring installation prior to starting installation.
B. Concrete surfaces to receive flooring shall have a smooth light steel trowel finish, within tolerances specified in Concrete section and cured with compounds acceptable as substrate for flooring system in accord with epoxy flooring system manufacturer's product data.
C. Concrete surfaces to receive flooring shall be free of dust, dirt, laitance, grease and other materials deleterious to proper bonding of flooring to substrates.

3.2 PREPARATION:
A. Prior to application of prime coat, clean surfaces to receive flooring. Remove debris, dirt and foreign substances.
B. Patch cracks and other imperfections in substrates in accord with epoxy flooring system manufacturer's product data.
C. Maintain slopes to drains in repair areas. Determine any deviations to the uniformly sloped
concrete substrates by either of the following methods:

1. Flood floor and mark residual puddles greater than 1/16" deep.
2. Use a 10'-0" metal straightedge and mark variations greater than 1/16".
3. Submit, in writing, a proposal for correcting any unsatisfactory conditions found from the above method(s) to the Architect.
4. Ensure that no ponding occurs in finished flooring system.

### 3.3 INSTALLATION OF EPOXY FORMULATION:

A. Apply flooring material in accord with manufacturer's product data. Rate of application shall not be less than recommended by manufacturer's product data.

B. Extend flooring material up wall surface to form integral coved base. Bond directly to wall surfaces. Bases in wet areas shall be free of seams which could allow water to enter substrate.

C. Primer: Mix and apply primer over properly prepared substrate with strict adherence to manufacturer's installation procedures and coverage rates.

D. Broadcast: Immediately broadcast quartz silica aggregate into the primer using manufacturer's specially designed spraycaster. Strict adherence to manufacturer's installation procedures and coverage rates is imperative.

E. Sealer: Remove excess unbonded granules by lightly brushing and vacuuming the floor surface. Mix and apply sealer with strict adherence to manufacturer's installation procedures.

F. Cure flooring for period recommended by manufacturer's product data before allowing traffic on surface.

G. Completed flooring shall be uniform in color, texture and aggregate distribution. Surface shall be in place and uniform and free of bubbles, foreign material, defect or irregularity. Trim edges and where material abuts adjacent construction. Edges at doors shall occur under closed door.

H. At terminations and doorways, sawcut concrete and chisel out to provide proper termination of flooring material; no featheredges allowed.

I. If slope between high points is found to be inadequate, correct slope to achieve proper runoff.

J. Site tolerances:
   1. Finished floor shall be level and true to line in an undivided space: +1/4"; maximum +1/16" in a running foot.
   2. No water shall stand between high point and low point (floor drain) on finished product.

### 3.4 CLEANING AND PROTECTION

A. During installation of a floor, do not allow foreign materials to enter floor drains. Leave drain covers and cleanouts loose, clean and accessible. Do not smear walls, columns, machinery or furniture with epoxy or other materials. Clean up aggregate and resins that are residuals to topping system.

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 1 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes ceilings composed of acoustical panels and exposed suspension systems.

1.3 SUBMITTALS

A. General: Submit each item in this Article according to the Conditions of the Contract and Division 1 Specification Sections.

B. Product data for each type of product specified to match existing in area of replacement

C. Coordination drawings for reflected ceiling plans drawn accurately to scale and coordinating penetrations and ceiling-mounted items. Show the following:
   1. Ceiling suspension system members.
   2. Method of attaching suspension system hangers to building structure.
   3. Ceiling-mounted items including light fixtures; air outlets and inlets; speakers; sprinklers; and special moldings at walls, column penetrations, and other junctures of acoustical ceilings with adjoining construction.

D. Samples for initial selection in the form of manufacturer’s color charts consisting of actual acoustical panels or sections of panels and sections of suspension system members showing the full range of colors, textures, and patterns available for each ceiling assembly indicated.

E. Samples for verification of each type of exposed finish required, prepared on samples of size indicated below. Where finishes involve normal color and texture variations, include sample sets showing the full range of variations expected.
   1. 6-inch- (150-mm-) square samples of each acoustical panel type, pattern, and color.
   2. Full-size samples of each acoustical panel type, pattern, and color.
   3. Set of 12-inch- (300-mm-) long samples of exposed suspension system members, including moldings, for each color and system type required.

F. Qualification data for firms and persons specified in the "Quality Assurance" Article to demonstrate their capabilities and experience. Include lists of completed projects with project names and addresses, names and addresses of architects and owners, and other information specified.

G. Product test reports from a qualified independent testing agency that are based on its testing of current products for compliance of acoustical panel ceilings and components with requirements.

H. Research reports or evaluation reports of the model code organization acceptable to authorities having jurisdiction that show compliance of acoustical panel ceilings and components with the building code in effect for the Project.

1.4 QUALITY ASSURANCE
A. Installer Qualifications: Engage an experienced Installer who has completed acoustical panel ceilings similar in material, design, and extent to that indicated for this Project and with a record of successful in-service performance.

B. Fire-Test-Response Characteristics: Provide acoustical panel ceilings that comply with the following requirements:
   1. Fire-response tests are performed by a qualified testing and inspecting agency. Qualified testing and inspecting agencies include Underwriters Laboratories (UL), Warnock Hersey, or another agency that is acceptable to authorities having jurisdiction and that performs testing and follow-up services.
   2. Surface-burning characteristics of acoustical panels comply with ASTM E 1264 for Class A materials as determined by testing identical products per ASTM E 84.
   3. Acoustical panel ceilings indicated are identical in materials and construction to those tested for fire resistance per ASTM E 119.
   4. Fire-resistance-rated, acoustical panel ceilings are indicated by design designations listed in the UL "Fire Resistance Directory," in the Warnock Hersey "Certification Listings," or in the listing of another qualified testing and inspecting agency.
   5. Products are identified with appropriate markings of applicable testing and inspecting agency.

C. Single-Source Responsibility for Ceiling Units: Obtain each type of acoustical ceiling panel from a single source with resources to provide products of consistent quality in appearance and physical properties without delaying the Work.

D. Single-Source Responsibility for Suspension System: Obtain each type of suspension system from a single source with resources to provide products of consistent quality in appearance and physical properties without delaying the Work.
   1. Obtain both acoustical panels and suspension system from the same manufacturer.

E. Preinstallation Conference: Conduct conference at Project site to comply with requirements of Division 1 Section "Project Meetings."

1.5 DELIVERY, STORAGE, AND HANDLING

A. Deliver acoustical panels and suspension system components to Project site in original, unopened packages and store them in a fully enclosed space where they will be protected against damage from moisture, direct sunlight, surface contamination, and other causes.

B. Before installing acoustical panels, permit them to reach room temperature and a stabilized moisture content.

C. Handle acoustical panels carefully to avoid chipping edges or damaging units in any way.

1.6 PROJECT CONDITIONS

A. Space Enclosure and Environmental Limitations: Do not install acoustical panel ceilings until spaces are enclosed and weatherproof, wet-work in spaces is completed and dry, work above ceilings is complete, and ambient temperature and humidity conditions are being maintained at the levels indicated for Project when occupied for its intended use.
1.7 COORDINATION

A. Coordinate layout and installation of acoustical panels and suspension system components with other construction that penetrates ceilings or is supported by them, including light fixtures, HVAC equipment, fire-suppression system components (if any), and partition assemblies (if any).

1.8 EXTRA MATERIALS

A. Furnish extra materials described below that match products installed, are packaged with protective covering for storage, and are identified with labels clearly describing contents.
1. Acoustical Ceiling Units: Furnish quantity of full-size units equal to 2.0 percent of amount installed.
2. Exposed Suspension System Components: Furnish quantity of each exposed component equal to 2.0 percent of amount installed.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Available Products: Subject to compliance with requirements, acoustical panels that may be incorporated in the Work include, but are not limited to, the following:

B. Products: Subject to compliance with requirements, provide one of the following for each panel type indicated or approved equivalent:
1. ACT#1 Non-Fire-Resistance-Rated, Water-Felted, Mineral-Base Panels. Sizes as shown. Provide one of the following:
   a. Radar Auratone Omni Fissured: USG Interiors, Inc.
   b. Minaboard Cortega; Armstrong World Industries, Inc.
   c. Acoustic–Tough Ceiling System; Soft Look Tunico, Tectum, Inc.
2. ACT#2 Fire-Resistance-Rated, Water-Felted, Mineral-Base Panels. Sizes as shown. Provide one of the following:
   a. Radar Auratone Fire Code Omni Fissured; USG Interiors, Inc.
   b. Fire Guard Cortega; Armstrong World Industries, Inc.
3. ACT#3 Non-Fire-Resistance-Rated, square edge, non-perforated, vinyl faced gypsum which satisfy USDA/FSIS guidelines for sanitary applications. Sizes as shown. Provide one of the following:
   a. VinylRock by Certain Teed.
   b. Sheetrock Lay-in Ceiling Panel ClimaPlus by USG
   c. Grinstone Brand Gypsum Ceiling Panels by National Gypsum

C. Available Products: Subject to compliance with requirements, products that may be incorporated in the Work include, but are not limited to, the products specified in each Acoustical Panel Ceiling Product Data Sheet at the end of this Section.

D. Products: Subject to compliance with requirements, provide one of the products specified in each Acoustical Panel Ceiling Product Data Sheet at the end of this Section.

2.2 ACOUSTICAL PANELS, GENERAL
FINISHES  
ACOUSTICAL CEILING TILE  
DIVISION 9  
SECTION 09511

A. Acoustical Panel Standard: Provide manufacturer's standard panels of configuration indicated that comply with ASTM E 1264 classifications as designated by types, patterns, acoustical ratings, and light reflectances, unless otherwise indicated.
   2. Test Method for Ceiling Attenuation Class (CAC): Where acoustical panel ceilings are specified to have a CAC, provide units identical to those tested per ASTM E 1414 by a qualified testing agency.

B. Acoustical Panel Colors and Patterns: Match appearance characteristics indicated for each product type.
   1. Where appearance characteristics of acoustical panels are indicated by reference to ASTM E 1264 pattern designations and not to manufacturers' proprietary product designations, provide products selected by Architect from each manufacturer's full range of products that comply with requirements indicated for type, pattern, color, light reflectance, acoustical performance, edge detail, and size.

C. Panel Characteristics: Comply with requirements indicated on each Acoustical Panel Ceiling Product Data Sheet at the end of this Section, including those referencing ASTM E 1264 classifications.

2.3 METAL SUSPENSION SYSTEMS, GENERAL

A. Metal Suspension System Standard: Provide manufacturer's standard metal suspension systems of types, structural classifications, and finishes indicated that comply with applicable ASTM C 635 requirements.

B. Finishes and Colors: Provide manufacturer's standard factory-applied finish for type of system indicated.
   1. High-Humidity Finish: Comply with ASTM C 635 requirements for "Coating Classification for Severe Environment Performance" where high-humidity finishes are indicated.

C. Attachment Devices: Size for 5 times the design load indicated in ASTM C 635, Table 1, Direct Hung unless otherwise indicated.

D. Wire Hangers, Braces, and Ties: Provide wires complying with the following requirements:
   3. Size: Select wire diameter so that its stress at 3 times the hanger design load (ASTM C 635, Table 1, Direct Hung) will be less than the yield stress of wire, but provide not less than 0.106-inch- (2.69-mm-) diameter wire.

E. Hanger Rods: Mild steel, zinc coated, or protected with rust-inhibitive paint.

F. Flat Hangers: Mild steel, zinc coated, or protected with rust-inhibitive paint.

G. Angle Hangers: Angles with legs not less than 7/8 inch (22 mm) wide, formed with 0.0396-inch- (1-mm-) thick galvanized-steel sheet complying with ASTM A 446, G 90 (ASTM A 446M, Z 275) Coating Designation, with bolted connections and 5/16-inch- (8-mm-) diameter bolts.
FINISHES ACOUSTICAL CEILING TILE
DIVISION 9 SECTION 09511

H. Sheet-Metal Edge Moldings and Trim: Type and profile indicated, or if not indicated, manufacturer's standard moldings for edges and penetrations that fit acoustical panel edge details and suspension systems indicated; formed from sheet metal of same material and finish as that used for exposed flanges of suspension system runners.
   1. For lay-in panels with reveal edge details, provide stepped-edge molding that forms reveal of same depth and width as that formed between edge of panel and flange at exposed suspension member.
   2. For circular penetrations of ceiling, provide edge moldings fabricated to diameter required to fit penetration exactly.
   3. For narrow-face suspension systems, provide suspension system and manufacturer's standard edge moldings that match width and configuration of exposed runners.

I. Hold-Down Clips for Non-Fire-Resistance-Rated Ceilings: For interior ceilings composed of acoustical panels weighing less than 1 lb per sq. ft. (4.88 kg per sq. m), provide hold-down clips spaced 24 inches (610 mm) o.c. on all cross tees.

J. Impact Clips: Where indicated, provide manufacturer's standard impact-clip system design to absorb impact forces against acoustical panels.

2.4 NON-FIRE-RESISTANCE-RATED, DIRECT-HUNG SUSPENSION SYSTEMS

A. Wide-Face, Single-Web, Steel Suspension System: Main and cross runners roll formed from prepainted or electrolytic zinc-coated, cold-rolled steel sheet, with prepainted 15/16-inch- (24-mm-) wide flanges; other characteristics as follows:
   2. Finish: Painted white.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates and structural framing to which acoustical panel ceilings attach or abut, with Installer present, for compliance with requirements specified in this and other Sections that affect ceiling installation and anchorage. Do not proceed with installation until unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Measure each ceiling area and establish the layout of acoustical panels to balance border widths at opposite edges of each ceiling. Avoid using less-than-half-width panels at borders, and conform to the layout shown on reflected ceiling plans.

3.3 INSTALLATION

A. General: Install acoustical panel ceilings to comply with publications referenced below per manufacturer's instructions and CISCA "Ceiling Systems Handbook."
   3. CISCA Recommendations for Acoustical Ceilings: Comply with CISCA "Recommendations
for Direct-Hung Acoustical Tile and Lay-In Panel Ceilings."


B. Suspend ceiling hangers from building's structural members and as follows:

1. Install hangers plumb and free from contact with insulation or other objects within ceiling plenum that are not part of the supporting structure or of the ceiling suspension system.

2. Splay hangers only where required to miss obstructions; offset resulting horizontal forces by bracing, countersplaying, or other equally effective means.

3. Splay hangers only where required, and if permitted with fire-resistance-rated ceilings, to miss obstructions; offset resulting horizontal forces by bracing, countersplaying, or other equally effective means.

4. Where width of ducts and other construction within ceiling plenum produces hanger spacings that interfere with the location of hangers at spacings required to support standard suspension system members, install supplemental suspension members and hangers in the form of trapezes or equivalent devices. Size supplemental suspension members and hangers to support ceiling loads within performance limits established by referenced standards and publications.

5. Secure wire hangers to ceiling suspension members and to supports above with a minimum of 3 tight turns. Connect hangers either directly to structures or to inserts, eye screws, or other devices that are secure, that are appropriate for substrate, and that will not deteriorate or otherwise fail due to age, corrosion, or elevated temperatures.

6. Secure flat, angle, channel, and rod hangers to structure, including intermediate framing members, by attaching to inserts, eye screws, or other devices that are secure and appropriate for both the structure to which hangers are attached and the type of hanger involved. Install hangers in a manner that will not cause them to deteriorate or fail due to age, corrosion, or elevated temperatures.

7. Secure bracing wires to ceiling suspension members and to supports with a minimum of 4 tight turns. Fasten bracing wires to concrete with cast-in-place or postinstalled anchors.

8. Do not support ceilings directly from permanent metal forms. Fasten hangers to cast-in-place hanger inserts, powder-actuated fasteners, or drilled-in anchors that extend through forms into concrete.

9. Do not attach hangers to steel deck tabs.

10. Do not attach hangers to steel roof deck. Attach hangers to structural members.

11. Space hangers not more than 48 inches (1200 mm) o.c. along each member supported directly from hangers, unless otherwise shown; and provide hangers not more than 8 inches (200 mm) from ends of each member.

C. Install edge moldings and trim of type indicated at perimeter of acoustical ceiling area and where necessary to conceal edges of acoustical panels.

1. Apply acoustical sealant in a continuous ribbon concealed on back of vertical legs of moldings before they are installed.

2. Screw attach moldings to substrate at intervals not over 16 inches (400 mm) o.c. and not more than 3 inches (75 mm) from ends, leveling with ceiling suspension system to a tolerance of 1/8 inch in 12 feet (3.18 mm in 3.66 m). Miter corners accurately and connect securely.

3. Do not use exposed fasteners, including pop rivets, on moldings and trim.

D. Install suspension system runners so they are square and securely interlocked with one another. Remove and replace dented, bent, or kinked members.
E. Install acoustical panels with undamaged edges and fitted accurately into suspension system runners and edge moldings. Scribe and cut panels at borders and penetrations to provide neat, precise fit.

1. Arrange directionally patterned acoustical panels as follows:
   a. In the manner indicated on reflected ceiling plans.
   b. Install panels with pattern running in one direction parallel to long axis of space.
   c. Install panels with pattern running in one direction parallel to short axis of space.
   d. Install panels in a basket-weave pattern.

2. For square-edged panels, install panels with edges fully hidden from view by flanges of suspension system runners and moldings.

3. For reveal-edged panels on suspension system runners, install panels with bottom of reveal in firm contact with top surface of runner flanges.

4. For reveal-edged panels on suspension system members with box-shaped flanges, install panels with reveal surfaces in firm contact with suspension system surfaces and panel faces flush with bottom face of runners.

5. Paint the cut panel edges remaining exposed after installation; match color of exposed panel surfaces using coating recommended for this purpose by acoustical panel manufacturer.

6. Install hold-down clips in areas indicated and in areas required by governing regulations, or for fire-resistance ratings; space as recommended by panel manufacturer, unless otherwise indicated or required.

7. Protect lighting fixtures and air ducts to comply with requirements indicated for fire-resistance-rated assembly.

3.4 CLEANING

A. Clean exposed surfaces of acoustical panel ceilings, including trim, edge moldings, and suspension system members. Comply with manufacturer's instructions for cleaning and touchup of minor finish damage. Remove and replace ceiling components that cannot be successfully cleaned and repaired to permanently eliminate evidence of damage.

END OF SECTION
PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Rubber or Vinyl Resilient Base

B. Related Requirements:
   1. Section 07901 - Joint Sealants: Sealant between bases and floor or wall surfaces.

1.2 REFERENCES

A. The publications listed below form a part of this specification to the extent referenced. Publications are referenced within the text by the basic designation only.

B. ASTM International (ASTM):
   1. ASTM E 84 - Surface Burning Characteristics of Building Materials.
   2. ASTM F1861 – Resilient Wall Base

1.3 SUBMITTALS

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

B. Samples for Initial Selection: Manufacturer's color charts consisting of units or sections of units showing the full range of colors and patterns available for each type of product indicated.

C. Samples for Verification: Manufacturer’s standard-size samples, but not less than 12 inches (300 mm) long, of each resilient accessory color and pattern specified.

D. Closeout:
   1. Product Certifications: Signed by manufacturers of resilient wall base products certifying that each product furnished complies with requirements.
   2. Maintenance Data: To be included in the maintenance manuals specified in Division 1.

1.4 QUALITY ASSURANCE

A. Installer Qualification: Engage an experienced installer to perform work of this Section who has specialized in installing resilient products similar to those required for this Project and with a record of successful in-service performance.

B. Source Limitations: Obtain each type, color, and pattern of product specified from one source with resources to provide products of consistent quality in appearance and physical properties without delaying the Work.

C. Fire-Test-Response Characteristics: Provide products with the following fire-test-response characteristics as determined by testing identical products per test method indicated below by a testing and inspecting agency acceptable to authorities having jurisdiction.
   1. Smoke Density: Maximum specific optical density of 450 or less when tested per ASTM E 662.

1.5 DELIVERY, STORAGE AND HANDLING

A. Transport, handle, store, and protect products in compliance with the requirements of Section 01600 and manufacturer's recommendations.
B. Product Packaging: Deliver in manufacturer's original packaging with identification markings on each component or package.

C. Move products into spaces where they will be installed at least 48 hours before installation, unless longer condition period of recommended in writing by manufacturer.

1.6 PROJECT CONDITIONS

A. Maintain a temperature of not less than 70 deg F (21 deg C) or more than 95 deg F (35 deg C) in spaces to receive products for at least 48 hours before installation, during installation, and for at least 48 hours after installation, unless manufacturer's written recommendations specify longer time periods. After post-installation period, maintain a temperature of not less than 55 deg F (13 deg C) or more than 95 deg F (35 deg C).

B. Do not install products until they are at the same temperature as the space where they are to be installed.

1.7 EXTRA MATERIALS

A. Furnish extra materials described below that match products installed, are packaged with protective covering for storage, and are identified with labels describing contents.

1. Furnish not less than 10 linear feet (3 linear m) for each 500 linear feet (150 linear m) or fraction thereof, of each type, color, pattern, and size of resilient accessory installed.

2. Deliver extra materials to Owner.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to the following:

1. Armstrong
2. Johnsonite
3. Roppe

2.2 PRODUCTS

A. Rubber or Vinyl Resilient Base: ASTM F1861, Type TV (vinyl), TS (rubber, vulcanized thermoset), or TP (rubber, thermoplastic); 1/8 inch thickness; with matching end stops and preformed corner units:

1. Color: To be selected by Architect or Owner’s representative.
2. Adhesive: Water resistant type, VOC less than 50 g/L as recommended by resilient base manufacturer for application intended.

B. Building Tape: 25 mil polyethylene backed rubberized adhesive membrane tape.

C. Regulatory Requirements: Conform to applicable code for flame/fuel/smoke rating requirements in accordance with ASTM E 84.

D. Substitutions: Comply with the requirements of Section 01600.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Rubber or Vinyl Resilient Base:

1. Comply with manufacturer's written instructions for installing resilient base.
2. Install resilient base in lengths as long as practical without gaps at seams and with tops of adjacent pieces aligned.
3. Tightly adhere resilient base to substrate throughout length of each piece, with base in continuous contact with horizontal and vertical substrates.
4. Do not stretch resilient base during installation.
5. On masonry surfaces or other similar irregular substrates, fill voids along top edge of resilient base with manufacturer's recommended adhesive filler material.
6. Install preformed corners before installing straight pieces.

B. Building Tape: Install building tape at base of wall behind resilient base. Install in accordance with manufacturer's instructions.

3.2 CLEANING

A. Remove excess adhesive from floor, base, and wall surfaces without damage.

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 work of this section.

1.2 DESCRIPTION OF WORK

A. Extent of each type of carpeting is indicated on drawings, finish schedule and by specifications, and is defined to include carpet, cushion and accessories.

1.3 QUALITY ASSURANCE

A. Manufacturer Qualifications: Firm (carpet mill) with not less than 5 years of production experience with carpet similar to types specified in this section; and whose published product literature clearly indicates general compliance of products with requirements of this section.

B. General Terminology/Information Standard: Refer to current edition of "Carpet Specifier's Handbook" by The Carpet and Rug Institute, for definitions of terminology not otherwise defined herein, and for general recommendations and information.

C. Flame/Smoke Resistance Standards: Where ratings are indicated for carpet or for carpet plus pad installations, provide materials complying with rating as indicated for the following test standards.
   1. Tunnel Test: Test for surface burning characteristics, with ratings for flame spread, fuel contribution, and or smoke density; ASTM E 84, UL 723, OR NFPA No. 255.
   2. Floor Radiant Panel Test: Test for burning under varying radiant energy levels; ASTM E 648, with minimum average radiant flux ratings not less than the following:
      a. FRPT Rating: 0.22 watts/sq. cm.
   3. Smoke Density Test: Test in radiant heat chamber, with and without flame, for density of smoke generated; ASTM E 662, or NFPA No. 258, also known as NBS Smoke Density Chamber Test.

D. Fade Resistance: Where fade resistance factor is indicated for carpet or carpet materials, provide materials which have been tested by AATCC Test Method 16 E, for a maximum grey scale factor of 4 when tested for a period of 40 hours except as otherwise indicated.

E. Static Resistance: Provide yarn or yarn blend as indicated in carpet construction, and include provisions to comply with static resistance ratings as indicated, either by selection of yarns known to be effective or by inclusion of small percentages of special anti-static yarn known to be effective in achieving indicated static resistance. Where rating is not otherwise indicated, provide 3.5 KV resistance for 20% R.H. at 70°F (21°C), AATCC 134.

1.4 SUBMITTALS

A. Product Data: Submit manufacturer's complete technical product data for each type of carpet, and accessory item required.

B. Samples: Submit 18” x 27” samples of each carpet required, 6” long samples of each type exposed edge stripping, and 6’ square samples of separate cushions.

C. Indicate range of available selection from manufacturer's standard carpet and colors.

D. Certification: Submit manufacturer's certification stating that carpet materials furnished comply
with specified requirements.

E. Maintenance Data: Submit manufacturer's printed maintenance recommendations, including methods and frequency recommended for maintaining carpet in optimum conditions under anticipated traffic and use conditions.

1.5 EXTRA STOCK

A. Overrun: Where carpet is supplied from custom run at mill, produce and deliver to project at least 5% overrun on calculated yardage. Provide required overrun exclusive of carpet needed for proper installation, waste and usable scraps.

1.6 PRODUCT DELIVERY AND STORAGE

A. Deliver carpeting materials in original mill protective wrapping with mill register numbers and tags attached. Store inside, in well ventilated area, protected from weather, moisture and soiling.

1.7 WARRANTY

A. Provide special project warranty, signed by Contractor, Installer and Manufacturer (Carpet Mill), agreeing to repair or replace defective materials and workmanship of carpeting work during 2 year warranty period following substantial completion. Attach copies of product warranties.

PART 2 - PRODUCTS

2.1 CARPET

A. Date Sheets Schedule: Detailed carpet construction and performance requirements for each required type of carpet are specified by either carpet data sheet at end of this section.

B. Carpet Fiber Used In Yarn.
   1. General: Refer to carpet data sheet schedules for fiber (filament) or fiber blend required for each type of carpet.

C. Carpet Color, Pattern, Texture.
   1. General: match Architect's sample(s) or match manufacturer's stock carpet(s) as designated for control section of color, pattern and texture.

D. Carpet Construction
   1. General: Fabricate carpet by the construction method indicated on data sheets, as recognized in the carpet industry, using manufacturer's (mill's) standard process.
   2. Pile Thickness (Height): Average height above backing, ASTM D 418, provide thicknesses indicated.
   3. Pile Face Weight: oz. per sq. yd. above backing, provide weights indicated.
   4. Stitches or Rows (Wires): Number of rows of tufts per in. of carpet length; provide rows indicated.
   5. Gage or Pitch: Gage spacing of tufts and pitch number of tufts in 27" measured at each row of tufts in width of carpet; provide gages or pitches indicated.
   6. Primary Backing: Except as otherwise indicated, provide woven construction or sheet goods, synthetic fibers or non-woven sheets, as applicable to carpet construction indicated, and appropriate for service and exposures indicated.
   7. Back Coating: Liquid latex or polyurethane coating or manufacturer's similar equivalent coating as required for carpet stability and tuft bind as indicated. Unless otherwise indicated provide tuft bind of not less than lbs. for looped pile, ASTM D 1335.
E. Carpet Tile:
1. Style: 24" x 24" modules
2. Construction: Broadloom
3. Fiber: Nylon
4. Gauge: 1/10
5. Face Yarn Weight 26 oz./sy. Min.
6. Color: As selected from Manufacturers standard colors

2.2 MANUFACTURERS

A. Subject to compliance with requirements, manufacturers offering carpet which may be incorporated in the work.
1. Shaw Industries.
3. Milliken and Co.
5. Stratton Industries.

2.3 CARPET ACCESSORIES

A. Carpet Edge Guard, Metallic: Extruded aluminum bend-down type edge guard with concealed gripper teeth and minimum 1/2" wide punched anchoring flange. Provide in hammered textured with anodized aluminum finish of colors selected by Architect from among standard colors available within the industry (any manufacturer).

B. Carpet Edge Guard, Nonmetallic: Extruded or molded heavy-duty vinyl or rubber carpet edge guard size and profile indicated and with among standard colors available within the industry (any Manufacturer).

C. Installation Adhesive: Water resistant, non-staining type; as recommended by carpet or cushion manufacturer, and which complies with flammability requirements for installed carpet.

D. Seaming Cement: Hot-melt seaming adhesive or similar product recommended by carpet manufacturer, for taping seams and buttering cut edges at backing to form secure seams and prevent pile loss at seams.

E. Miscellaneous Materials: As recommended by manufacturers of carpet, cushions and other carpeting products; and selected by Installer to meet project circumstance and requirements.

PART 3 - EXECUTION

3.1 PRE-INSTALLATION REQUIREMENTS

A. Examine substrates for moisture content and other conditions under which carpeting is to be installed. Repair minor holes, cracks, depressions or rough areas using material recommended by carpet or adhesive manufacturer. Do not proceed until unsatisfactory conditions have been corrected.

B. Clear away debris and scrape up cementitious deposits from surfaces to receive carpeting, vacuum clean immediately before installation. Check concrete surfaces to ensure no "dusting" through installed carpet, apply sealer where required to prevent dusting.

C. Sequence carpeting with other work so as to minimize possibility of damage and soiling of carpet
during remainder of construction period.

3.2 INSTALLATION

A. General:
   1. Comply with manufacturer's instructions and recommendations for seam locations and direction of carpet, maintain uniformity of carpet direction and lay of pile. At doors, center seams under doors, do not place seams in traffic direction at doorways.
   2. Extend carpet under open bottomed obstructions and under removable flanges and furnishing, and into alcoves and closets of each space.
   3. Provide cut-outs where required, and bind cut edges properly where not concealed by protective edge guards or overlapping flanges.
   4. Install carpet edge guard where edge of carpet is exposed, anchor guards to substrate.
   5. Expansion Joints: Do not bridge building expansion joints with continuous carpeting, provide for movement.

B. Glue down Installation:
   1. Fit sections of carpet into each space prior to application of adhesive. Trim edges and butter cuts with seaming cement.
   2. Apply adhesive uniformly to substrate in accordance with manufacturer's instructions. Butt carpet edges tightly together to form seams without gaps. Roll entire carpet area lightly to eliminate air pockets and ensure uniform bond. Remove adhesive promptly from face of carpet.

3.3 CLEANING AND PROTECTION

A. Remove and dispose of debris and unusable scraps.

B. Vacuum carpet using commercial machine with face beater element. Remove spots and replace carpet where spots cannot be removed. Remove any protruding face yarn using sharp scissors.

C. Provide protection methods and materials needed to ensure that carpeting will be without deterioration or damage at time of substantial completion.

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 1 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes surface preparation and field painting of the following:
   1. Exposed exterior items and surfaces.
   2. Exposed interior items and surfaces.
   3. Surface preparation, priming, and finish coats specified in this Section are in addition to shop priming and surface treatment specified in other Sections.

B. Paint exposed surfaces, except where the paint schedules indicate that a surface or material is not to be painted or is to remain natural. If the paint schedules do not specifically mention an item or a surface, paint the item or surface the same as similar adjacent materials or surfaces whether or not schedules indicate colors. If the schedules do not indicate color or finish, the Architect will select from standard colors and finishes available.
   1. Painting includes field painting of exposed bare and covered pipes and ducts (including color coding), hangers, exposed steel and iron work, and primed metal surfaces of mechanical and electrical equipment.

C. Do not paint prefinished items, concealed surfaces, finished metal surfaces, operating parts, and labels.
   1. Prefinished items include the following factory-finished components:
      a. Architectural woodwork and casework.
      b. Acoustical wall panels.
      c. Metal toilet enclosures.
      d. Elevator entrance doors and frames.
      e. Elevator equipment.
      f. Finished mechanical and electrical equipment.
      g. Light fixtures.
      h. Distribution cabinets.
   2. Concealed surfaces include walls or ceilings in the following generally inaccessible spaces:
      a. Foundation spaces.
      b. Furred areas.
      c. Ceiling plenums.
      d. Utility tunnels.
      e. Pipe spaces.
      f. Duct shafts.
      g. Elevator shafts.
   3. Finished metal surfaces include the following:
      a. Anodized aluminum.
      b. Stainless steel.
      c. Chromium plate.
      d. Copper.
      e. Bronze and brass.
   4. Operating parts include moving parts of operating equipment and the following:
      a. Valve and damper operators.
b. Linkages.
c. Sensing devices.
d. Motor and fan shafts.

5. Labels: Do not paint over Underwriters Laboratories (UL), Factory Mutual (FM), or other code-required labels or equipment name, identification, performance rating, or nomenclature plates.

D. Related Sections include the following:
1. Division 5 Section "Metal Fabrications" for shop priming ferrous metal.
2. Division 8 Section "Steel Doors and Frames" for shop priming steel doors and frames.
3. Division 9 Section "Gypsum Board Assemblies" for surface preparation for gypsum board.

1.3 DEFINITIONS

A. General: Standard coating terms defined in ASTM D 16 apply to this Section.
1. Flat refers to a lusterless or matte finish with a gloss range below 15 when measured at an 85-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-sheen finish with a gloss range between 15 and 35 when measured at a 60-degree meter.
4. Semigloss refers to medium-sheen finish with a gloss range between 30 and 65 when measured at a 60-degree meter.
5. Full 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: For each paint system specified. Include block fillers and primers.
1. Material List: Provide an inclusive list of required coating materials. Indicate each material and cross-reference specific coating, finish system, and application. Identify each material by manufacturer's catalog number and general classification.
2. Manufacturer's Information: Provide manufacturer's technical information, including label analysis and instructions for handling, storing, and applying each coating material proposed for use.
3. Certification by the manufacturer that products supplied comply with local regulations controlling use of volatile organic compounds (VOCs).

B. Samples for Initial Selection: Manufacturer's color charts showing the full range of colors available for each type of finish-coat material indicated.
1. After color selection, the Architect will furnish color chips for surfaces to be coated.

C. Samples for Verification: Of each color and material to be applied, with texture to simulate actual conditions, on representative Samples of the actual substrate.
1. Provide stepped Samples, defining each separate coat, including block fillers and primers. Use representative colors when preparing Samples for review. Resubmit until required sheen, color, and texture are achieved.
2. Provide a list of materials and applications for each coat of each sample. Label each sample for location and application.

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

1.5 QUALITY ASSURANCE

A. Applicator Qualifications: Engage an experienced applicator who has completed painting system applications similar in material and extent to that indicated for this Project with a record of successful in-service performance.

B. Source Limitations: Obtain block fillers, primers, and undercoat materials for each coating system from the same manufacturer as the finish coats.

C. Benchmark Samples (Mockups): Provide a full-coat benchmark finish sample of each type of coating and substrate required on the Project. Comply with procedures specified in PDCA P5. Duplicate finish of approved prepared samples.

1. The Architect will select one room or surface to represent surfaces and conditions for each type of coating and substrate to be painted.
   a. Wall Surfaces: Provide samples on at least 100 sq. ft. (9 sq. m) of wall surface.
   b. Small Areas and Items: The Architect will designate an item or area as required.

2. After permanent lighting and other environmental services have been activated, apply coatings in this room or to each surface according to the Schedule or as specified. Provide required sheen, color, and texture on each surface.
   a. After finishes are accepted, the Architect will use the room or surface to evaluate coating systems of a similar nature.

3. Final approval of colors will be from job-applied samples.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Deliver materials to the Project Site in manufacturer's original, unopened packages and containers bearing manufacturer's name and label, and the following information:
   1. Product name or title of material.
   2. Product description (generic classification or binder type).
   3. Manufacturer's stock number and date of manufacture.
   4. Contents by volume, for pigment and vehicle constituents.
   5. Thinning instructions.
   6. Application instructions.
   7. Color name and number.
   8. VOC content.

B. Store materials not in use in tightly covered containers in a well-ventilated area at a minimum ambient temperature of 45 deg F (7 deg C). Maintain containers used in storage in a clean condition, free of foreign materials and residue.
   1. Protect from freezing. Keep storage area neat and orderly. Remove oily rags and waste daily. Take necessary measures to ensure that workers and work areas are protected from fire and health hazards resulting from handling, mixing, and application.

1.7 PROJECT CONDITIONS

A. Apply water-based paints only when the temperature of surfaces to be painted and surrounding air temperatures are between 50 and 90 deg F (10 and 32 deg C).
B. Apply solvent-thinned paints only when the temperature of surfaces to be painted and surrounding air temperatures are between 45 and 95 deg F (7.2 and 35 deg C).

C. Do not apply paint in snow, rain, fog, or mist; or when the relative humidity exceeds 85 percent; or at temperatures less than 5 deg F (3 deg C) above the dew point; or to damp or wet surfaces.
   1. Painting may continue during inclement weather if surfaces and areas to be painted are enclosed and heated within temperature limits specified by manufacturer during application and drying periods.

1.8 EXTRA MATERIALS

A. Furnish extra paint materials from the same production run as the materials applied in the quantities described below. Package paint materials in unopened, factory-sealed containers for storage and identify with labels describing contents. Deliver extra materials to the Owner.
   1. Quantity: Furnish the Owner with an additional 5 percent, but not less than 1 gal. (3.785 L) or 1 case, as appropriate, of each material and color applied.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, products listed in the paint schedules.

B. Products: Subject to compliance with requirements, provide one of the products in the paint schedules.

C. Manufacturers Names: The following manufacturers are referred to in the paint schedules by use of shortened versions of their names, which are shown in parentheses:
   1. Devoe & Raynolds Co. (Devoe).
   2. Fuller-O'Brien Paints (Fuller).
   3. Glidden Co. (The) (Glidden).
   5. PPG Industries, Inc. (PPG).
   7. Sherwin-Williams Co. (S-W).

2.2 PAINT MATERIALS, GENERAL

A. Material Compatibility: Provide block fillers, primers, undercoats, and finish-coat materials that are compatible with one another and the substrates indicated under conditions of service and application, as demonstrated by manufacturer based on testing and field experience.

B. Material Quality: Provide manufacturer's best-quality paint material of the various coating types specified. Paint-material containers not displaying manufacturer's product identification will not be acceptable.
   1. Proprietary Names: Use of manufacturer's proprietary product names to designate colors or materials is not intended to imply that products named are required to be used to the exclusion of equivalent products of other manufacturers. Furnish manufacturer's material data and certificates of performance for proposed substitutions.
PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with the Applicator present, under which painting will be performed for compliance with paint application requirements.
   1. Do not begin to apply paint until unsatisfactory conditions have been corrected and surfaces receiving paint are thoroughly dry.
   2. Start of painting will be construed as the Applicator's acceptance of surfaces and conditions within a particular area.

B. Coordination of Work: Review other Sections in which primers are provided to ensure compatibility of the total system for various substrates. On request, furnish information on characteristics of finish materials to ensure use of compatible primers.
   1. Notify the Architect about anticipated problems using the materials specified over substrates primed by others.

3.2 PREPARATION

A. General: Remove hardware and hardware accessories, plates, machined surfaces, lighting fixtures, and similar items already installed that are not to be painted. If removal is impractical or impossible because of the size or weight of the item, provide surface-applied protection before surface preparation and painting.
   1. After completing painting operations in each space or area, reinstall items removed using workers skilled in the trades involved.

B. Cleaning: Before applying paint or other surface treatments, clean the substrates of substances that could impair the bond of the various coatings. Remove oil and grease before cleaning.
   1. Schedule cleaning and painting so dust and other contaminants from the cleaning process will not fall on wet, newly painted surfaces.

C. Surface Preparation: Clean and prepare surfaces to be painted according to manufacturer's written instructions for each particular substrate condition and as specified.
   1. Provide barrier coats over incompatible primers or remove and reprime.
   2. Cementitious Materials: Prepare concrete, concrete masonry block, cement plaster, and mineral-fiber-reinforced cement panel surfaces to be painted. Remove efflorescence, chalk, dust, dirt, grease, oils, and release agents. Roughen as required to remove glaze. If hardeners or sealers have been used to improve curing, use mechanical methods of surface preparation.
      a. Use abrasive blast-cleaning methods if recommended by paint manufacturer.
      b. Determine alkalinity and moisture content of surfaces by performing appropriate tests. If surfaces are sufficiently alkaline to cause the finish paint to blister and burn, correct this condition before application. Do not paint surfaces where moisture content exceeds that permitted in manufacturer's written instructions.
      c. Clean concrete floors to be painted with a 5 percent solution of muriatic acid or other etching cleaner. Flush the floor with clean water to remove acid, neutralize with
3. Wood: Clean surfaces of dirt, oil, and other foreign substances with scrapers, mineral spirits, and sandpaper, as required. Sand surfaces exposed to view smooth and dust off.
   a. Scrape and clean small, dry, seasoned knots, and apply a thin coat of white shellac or other recommended knot sealer before applying primer. After priming, fill holes and imperfections in finish surfaces with putty or plastic wood filler. Sand smooth when dried.
   b. Prime, stain, or seal wood to be painted immediately on delivery. Prime edges, ends, faces, undersides, and backsides of wood, including cabinets, counters, cases, and paneling.
   c. When transparent finish is required, backprime with spar varnish.
   d. Backprime paneling on interior partitions where masonry, plaster, or other wet wall construction occurs on backside.
   e. Seal tops, bottoms, and cutouts of unprimed wood doors with a heavy coat of varnish or sealer immediately on delivery.
4. Ferrous Metals: Clean ungalvanized ferrous-metal surfaces that have not been shop coated; remove oil, grease, dirt, loose mill scale, and other foreign substances. Use solvent or mechanical cleaning methods that comply with the Steel Structures Painting Council's (SSPC) recommendations.
   a. Blast steel surfaces clean as recommended by paint system manufacturer and according to requirements of SSPC-SP 10.
   b. Treat bare and sandblasted or pickled clean metal with a metal treatment wash coat before priming.
   c. Touch up bare areas and shop-applied prime coats that have been damaged. Wire-brush, clean with solvents recommended by paint manufacturer, and touch up with the same primer as the shop coat.
5. Galvanized Surfaces: Clean galvanized surfaces with nonpetroleum-based solvents so surface is free of oil and surface contaminants. Remove pretreatment from galvanized sheet metal fabricated from coil stock by mechanical methods.

D. Materials Preparation: Mix and prepare paint materials according to manufacturer's written instructions.
   1. Maintain containers used in mixing and applying paint in a clean condition, free of foreign materials and residue.
   2. Stir material before application to produce a mixture of uniform density. Stir as required during application. Do not stir surface film into material. If necessary, remove surface film and strain material before using.
   3. Use only thinners approved by paint manufacturer and only within recommended limits.

E. Tinting: Tint each undercoat a lighter shade to simplify identification of each coat when multiple coats of the same material are applied. Tint undercoats to match the color of the finish coat, but provide sufficient differences in shade of undercoats to distinguish each separate coat.

3.3 APPLICATION

A. General: Apply paint according to manufacturer's written instructions. Use applicators and techniques best suited for substrate and type of material being applied.
   1. Paint colors, surface treatments, and finishes are indicated in the schedules.
   2. Do not paint over dirt, rust, scale, grease, moisture, scuffed surfaces, or conditions detrimental to formation of a durable paint film.
   3. Provide finish coats that are compatible with primers used.
4. The term "exposed surfaces" includes areas visible when permanent or built-in fixtures, convector covers, covers for finned-tube radiation, grilles, and similar components are in place. Extend coatings in these areas, as required, to maintain the system integrity and provide desired protection.

5. Paint surfaces behind movable equipment and furniture the same as similar exposed surfaces. Before the final installation of equipment, paint surfaces behind permanently fixed equipment or furniture with prime coat only.

6. Paint interior surfaces of ducts with a flat, nonspecular black paint where visible through registers or grilles.

7. Paint back sides of access panels and removable or hinged covers to match exposed surfaces.

8. Finish exterior doors on tops, bottoms, and side edges the same as exterior faces.

9. Finish interior of wall and base cabinets and similar field-finished casework to match exterior.

10. Sand lightly between each succeeding enamel or varnish coat.

B. Scheduling Painting: Apply first coat to surfaces that have been cleaned, pretreated, or otherwise prepared for painting as soon as practicable after preparation and before subsequent surface deterioration.

1. The number of coats and the film thickness required are the same regardless of application method. Do not apply succeeding coats until the previous coat has cured as recommended by the manufacturer. If sanding is required to produce a smooth, even surface according to manufacturer's written instructions, sand between applications.

2. Omit primer on metal surfaces that have been shop primed and touchup painted.

3. If undercoats, stains, or other conditions show through final coat of paint, apply additional coats until paint film is of uniform finish, color, and appearance. Give special attention to ensure edges, corners, crevices, welds, and exposed fasteners receive a dry film thickness equivalent to that of flat surfaces.

4. Allow sufficient time between successive coats to permit proper drying. Do not recoat surfaces until paint has dried to where it feels firm, does not deform or feel sticky under moderate thumb pressure, and where application of another coat of paint does not cause the undercoat to lift or lose adhesion.

C. Application Procedures: Apply paints and coatings by brush, roller, spray, or other applicators according to manufacturer's written instructions.

1. Brushes: Use brushes best suited for the type of material applied. Use brush of appropriate size for the surface or item being painted.

2. Rollers: Use rollers of carpet, velvet back, or high-pile sheep's wool as recommended by the manufacturer for the material and texture required.

3. Spray Equipment: Use airless spray equipment with orifice size as recommended by the manufacturer for the material and texture required.

D. Minimum Coating Thickness: Apply paint materials no thinner than manufacturer's recommended spreading rate. Provide the total dry film thickness of the entire system as recommended by the manufacturer.

E. Mechanical and Electrical Work: Painting of mechanical and electrical work is limited to items exposed in equipment rooms and in occupied spaces.

F. Mechanical items to be painted include, but are not limited to, the following:

1. Piping, pipe hangers, and supports.
3. Tanks.
4. Ductwork.
5. Insulation.
6. Motors and mechanical equipment.
7. Accessory items.

G. Electrical items to be painted include, but are not limited to, the following:
1. Conduit and fittings.
2. Switchgear.
3. Panelboards.

H. Block Fillers: Apply block fillers to concrete masonry block at a rate to ensure complete coverage with pores filled.

I. Prime Coats: Before applying finish coats, apply a prime coat of material, as recommended by the manufacturer, to material that is required to be painted or finished and that has not been prime coated by others. Recoat primed and sealed surfaces where evidence of suction spots or unsealed areas in first coat appears, to ensure a finish coat with no burn through or other defects due to insufficient sealing.

J. Pigmented (Opaque) Finishes: Completely cover surfaces as necessary to provide a smooth, opaque surface of uniform finish, color, appearance, and coverage. Cloudiness, spotting, holidays, laps, brush marks, runs, sags, ropiness, or other surface imperfections will not be acceptable.

K. Transparent (Clear) Finishes: Use multiple coats to produce a glass-smooth surface film of even luster. Provide a finish free of laps, runs, cloudiness, color irregularity, brush marks, orange peel, nail holes, or other surface imperfections.
1. Provide satin finish for final coats.

L. Completed Work: Match approved samples for color, texture, and coverage. Remove, refinish, or repaint work not complying with requirements.

3.4 FIELD QUALITY CONTROL

A. The Owner reserves the right to invoke the following test procedure at any time and as often as the Owner deems necessary during the period when paint is being applied:
1. The Owner will engage the services of an independent testing agency to sample the paint material being used. Samples of material delivered to the Project will be taken, identified, sealed, and certified in the presence of the Contractor.
2. The testing agency will perform appropriate tests for the following characteristics as required by the Owner:
   a. Quantitative material analysis.
   b. Abrasion resistance.
   c. Apparent reflectivity.
   d. Flexibility.
   e. Washability.
   f. Absorption.
   g. Accelerated weathering.
   h. Dry opacity.
i. Accelerated yellowness.
j. Recoating.
k. Skinning.
l. Color retention.
m. Alkali and mildew resistance.

3. The Owner may direct the Contractor to stop painting if test results show material being used does not comply with specified requirements. The Contractor shall remove noncomplying paint from the site, pay for testing, and repaint surfaces previously coated with the rejected paint. If necessary, the Contractor may be required to remove rejected paint from previously painted surfaces if, on repainting with specified paint, the 2 coatings are incompatible.

3.5 CLEANING

A. Cleanup: At the end of each workday, remove empty cans, rags, rubbish, and other discarded paint materials from the site.
   1. After completing painting, clean glass and paint-spattered surfaces. Remove spattered paint by washing and scraping. Be careful not to scratch or damage adjacent finished surfaces.

3.6 PROTECTION

A. Protect work of other trades, whether being painted or not, against damage by painting. Correct damage by cleaning, repairing or replacing, and repainting, as approved by Architect.

B. Provide "Wet Paint" signs to protect newly painted finishes. Remove temporary protective wrappings provided by others to protect their work after completing painting operations.
   1. At completion of construction activities of other trades, touch up and restore damaged or defaced painted surfaces. Comply with procedures specified in PDCA P1.

3.7 PAINT SHEEN SCHEDULE

A. Gloss:
   1. Exterior metal surfaces.
   2. Exterior hollow metal doors and frames (inside and outside surfaces).
   3. Roof hatch (inside and outside surfaces).
   4. Interior & exterior pipe bollards.
   5. Interior & exterior metal railings.
   6. Metal stair stringers and handrails.
   7. Metal fixed ladders and cages.

B. Semi-gloss:
   1. Interior hollow metal doors and frames.
   2. Interior hollow metal window frames.
   3. Wood trim or simulated wood trim scheduled to be painted.
   4. Coiling metal counter doors.
   5. Toilet gypsum board ceilings.
   6. Interior columns surfaces to receive epoxy finish.

C. Eggshell:
1. All surfaces to be painted where a sheen is not otherwise specified.

D. Flat:
2. Exterior gypsum board ceilings.

3.8 PAINT SCHEDULE

A. Apply paint to the substrate surface scheduled as applicable as specified or as shown on the drawings in accordance with the following:

<table>
<thead>
<tr>
<th>Surface</th>
<th>Sheen</th>
<th>1st Coat</th>
<th>DFT (mils) (per coat)</th>
<th>VOC (g/l)</th>
<th>2nd and 3rd Coats</th>
<th>DFT (mils) (per coat)</th>
<th>VOC (g/l)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Exterior Painting Schedule</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Ferrous Metal</td>
<td>Gloss</td>
<td>Pro Industrial ProCryl Universal Primer B66-310</td>
<td>3.0</td>
<td>100</td>
<td>2 Coats: Pro Industrial Zero VOC Enamel, B66-600 Series</td>
<td>4.0</td>
<td>0</td>
</tr>
<tr>
<td>Ferrous Metal</td>
<td>Gloss</td>
<td>Pro Industrial Zero VOC Enamel, B66-600 Series</td>
<td>4.0</td>
<td>0</td>
<td>1 Coat: Pro Industrial Zero VOC Enamel, B66-600 Series</td>
<td>4.0</td>
<td>0</td>
</tr>
<tr>
<td>Ferrous Metal (Existing roof mounted equip framing to remain)</td>
<td>Gloss</td>
<td>All States except CA: Epolon II Rust Inhibitive Epoxy Primer B67W400, B67A400, B67A400 State of CA: Macropoxy 646-100, B58W620, B58V620</td>
<td>4.0</td>
<td>300</td>
<td>2 Coats: WB Acrolon 100 Water Based Urethane B65-720, B65V720</td>
<td>2-4</td>
<td>&lt;10 0</td>
</tr>
<tr>
<td>Ferrous Metal (Satellite dish support and exposed rooftop refrigeration and HVAC support framing.)</td>
<td>Gloss</td>
<td>Pro Industrial ProCryl Universal Primer B66-310</td>
<td>4.0</td>
<td>100</td>
<td>2 Coats: WB Acrolon 100 Water Based Urethane B65-720, B65V720</td>
<td>2-4</td>
<td>&lt;10 0</td>
</tr>
<tr>
<td>Prefinished Ferrous Metal</td>
<td>Gloss</td>
<td>PrepRite Bonding Primer B51W50</td>
<td>4</td>
<td>42</td>
<td>1 Coat: Pro Industrial Zero VOC Enamel, B66-600 Series</td>
<td>4.0</td>
<td>0</td>
</tr>
<tr>
<td>Surface</td>
<td>Sheen</td>
<td>1st Coat</td>
<td>DFT (mils) (per coat)</td>
<td>VOC (g/l)</td>
<td>2nd and 3rd Coats</td>
<td>DFT (mils) (per coat)</td>
<td>VOC (g/l)</td>
</tr>
<tr>
<td>----------------------------------------------</td>
<td>-------</td>
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<td>-----------------------</td>
<td>-----------</td>
<td>------------------------------------------------------------</td>
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<td>-----------</td>
</tr>
<tr>
<td>(Underside of metal roof panels where exposed)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Prefinished Metal Trim (If shown to be repainted)</td>
<td>Low Sheen</td>
<td>Bond-Plex Waterbased Acrylic B71-200 Series</td>
<td>4.0</td>
<td>48</td>
<td>1 Coat: Bond-Plex Waterbased Acrylic B71-200 Series</td>
<td>4.0</td>
<td>48</td>
</tr>
<tr>
<td>Galvanized Trim</td>
<td>Semi-gloss</td>
<td>Pro Industrial ProCryl Universal Primer B66-310</td>
<td>3.0</td>
<td>100</td>
<td>2 Coats: Pro Industrial Zero VOC Enamel, B66-600 Series</td>
<td>4.0</td>
<td>0</td>
</tr>
<tr>
<td>Nonferrous and Galvanized Metal</td>
<td>Semi-gloss</td>
<td>Pro Industrial ProCryl Universal Primer B66-310</td>
<td>3.0</td>
<td>100</td>
<td>2 Coats: Pro Industrial Zero VOC Enamel, B66-600 Series</td>
<td>4.0</td>
<td>0</td>
</tr>
<tr>
<td>Concrete Masonry Unit Elastomeric (50 degrees F or above)</td>
<td>Flat</td>
<td>Heavy Duty Block Filler B42W46</td>
<td>18.0</td>
<td>100</td>
<td>2 Coats: Conflex XL High Build Elastomeric, A5-400</td>
<td>6-7.5</td>
<td>97</td>
</tr>
<tr>
<td>Concrete Masonry Unit Elastomeric (Below 50 degrees F)</td>
<td>Flat</td>
<td>Loxon Block Surfacer, A24W200 (Above 35°F)</td>
<td>8.0</td>
<td>81</td>
<td>2 Coats: UltraCrete Solvent Borne Masonry Coating, B46 Series (Above 20° F)</td>
<td>6-8</td>
<td>400</td>
</tr>
<tr>
<td>Exterior Insulation and Finish System</td>
<td>Flat</td>
<td>A-100 Exterior Latex Finish, A6-100 Series</td>
<td>1.3</td>
<td>49</td>
<td>1 Coat: A-100 Exterior Latex Finish, A6-100 Series</td>
<td>1.3</td>
<td>49</td>
</tr>
<tr>
<td>Fiber Cement Siding</td>
<td>Flat</td>
<td>Loxon Concrete and Masonry Primer, B28W8300</td>
<td>3.2</td>
<td>96</td>
<td>2 Coats: A-100 Exterior Latex Finish, A6-100 Series</td>
<td>1.3</td>
<td>49</td>
</tr>
<tr>
<td>Precast Concrete</td>
<td>Flat</td>
<td>Loxon Concrete and Masonry Primer, B28W8300</td>
<td>3.2</td>
<td>96</td>
<td>2 Coats: A-100 Exterior Latex Finish, A6-100 Series</td>
<td>1.3</td>
<td>49</td>
</tr>
<tr>
<td>Exposed Timber, Purlins,</td>
<td>Semi-Transparant</td>
<td>WoodScapes Polyurethane Stain A15T5</td>
<td>1.3</td>
<td>79</td>
<td>1 Coat: WoodScapes Polyurethane Stain A15T5</td>
<td>1.3</td>
<td>79</td>
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<tr>
<td>Surface</td>
<td>Sheen</td>
<td>1st Coat</td>
<td>DFT (mils) (per coat)</td>
<td>VO C (g/l)</td>
<td>2nd and 3rd Coats</td>
<td>DFT (mils) (per coat)</td>
<td>VO C (g/l)</td>
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<td>---------------------------------</td>
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<td>-----------------------</td>
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<tr>
<td>Plywood</td>
<td>Stain</td>
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<td></td>
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<td>Exposed</td>
<td>Opaque Stain</td>
<td>1 Coat: WoodScapes Latex Stain A15W51</td>
<td>1.3-2.6</td>
<td>&lt;10</td>
<td>1 Coat: WoodScapes Latex Stain A15W51</td>
<td>1.3-2.6</td>
<td>&lt;10</td>
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<tr>
<td>Plywood, Purlins, Plywood, Wood</td>
<td>Flat</td>
<td>A-100 Exterior Latex Primer, B42W43</td>
<td>1.4</td>
<td>87</td>
<td>2 Coats: A-100 Exterior Latex Finish, A6-100 Series</td>
<td>1.3</td>
<td>49</td>
</tr>
<tr>
<td>Gypsum Board</td>
<td>Flat</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>Concrete Pavement</td>
<td>Eggshell</td>
<td>Setfast Acrylic Waterborne Traffic Marking Paint, TM 226/227</td>
<td>8.5</td>
<td>100</td>
<td>1 Coat: Setfast Acrylic Waterborne Traffic Marking Paint, TM 226/227</td>
<td>8.5</td>
<td>100</td>
</tr>
</tbody>
</table>

**INTERIOR PAINTING SCHEDULE**

<p>| Ferrous Metal                   | Gloss       | Pro Industrial ProCryl Universal Primer B66-310 | 2                     | 100       | All States except CA: 2 Coats: Pro Mar 200 Interior Latex Gloss Enamel, B21W200 | 1.5                   | 143       |
|                                 |             |                                               |                       |           | State of CA: 2 Coats: Solo Gloss Low VOC Enamel, B21WJ Series | 1.6                   | 49        |
| Ferrous Metal                   | Semigloss   | ProCryl Universal Primer B66-310               | 2                     | 100       | 2 coats: ProMar 200 Zero VOC Interior Latex Semi-Gloss Enamel, B31-2600 Series | 1.6                   | 0         |
| Ferrous Metal                   | Eggshell    | Pro Industrial ProCryl Universal Primer B66-310 | 2                     | 100       | 2 Coats: ProMar 200 Zero VOC Interior Latex Eggshell Enamel, B20-2600 Series. Exception: Interior columns shall receive only 1 coat. | 1.7                   | 0         |
| Ferrous Metal                   | Flat        | Waterborne Acrylic Dryfall, B42 Series Touch up prime welds, bare spots, blemishes, and scratches with Pro Industrial ProCryl Universal Primer B66-310 | 4.5                   | 58        |                                                      |                       |           |
| Ferrous Metal                   | Flat        | Pro Industrial ProCryl Universal Primer B66-310 | 2                     | 100       | 1 coat: Waterborne Acrylic Dryfall, B42 Series       | 4.5                   | 58        |</p>
<table>
<thead>
<tr>
<th>Surface</th>
<th>Sheen</th>
<th>1st Coat</th>
<th>DFT (mils) (per coat)</th>
<th>VOC (g/l)</th>
<th>2nd and 3rd Coats</th>
<th>DFT (mils) (per coat)</th>
<th>VOC (g/l)</th>
</tr>
</thead>
<tbody>
<tr>
<td>(Dryfall system over unprimed steel - overhead structure)</td>
<td>Semi-gloss</td>
<td>All states except CA: Epolon II Rust Inhibitive Epoxy Primer B67W400, B67A400, B67A400 State of CA: Macropoxy 646-100, B58W620, B58V620</td>
<td>4.0</td>
<td>300</td>
<td>1 Coat: WB Acrolon 100 Water Based Urethane B65-720, B65V720.</td>
<td>2-4</td>
<td>&lt;10</td>
</tr>
<tr>
<td>Ferrous Metal (Columns and Hollow Metal Door Frames as shown on Drawings to receive epoxy)</td>
<td>Semi-gloss</td>
<td>All states except CA: Epolon II Rust Inhibitive Epoxy Primer B67W400, B67A400, B67A400 State of CA: Macropoxy 646-100, B58W620, B58V620</td>
<td>5.0-10.0</td>
<td>0</td>
<td>1 Coat: WB Acrolon 100 Water Based Urethane B65-720, B65V720.</td>
<td>2-4</td>
<td>&lt;10</td>
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<tr>
<td>Galvanized Metal (Exposed Ductwork)</td>
<td>Flat</td>
<td>Pro Industrial ProCryl Universal Primer B66-310</td>
<td>2</td>
<td>100</td>
<td>1 coat: Waterborne Acrylic Dryfall, B42 Series</td>
<td>4.5</td>
<td>100</td>
</tr>
<tr>
<td>Galvanized Metal (Freezer/cooler panels)</td>
<td>Eggshe...</td>
<td>Pro Industrial ProCryl Universal Primer B66-310</td>
<td>2</td>
<td>100</td>
<td>2 Coats: ProMar 200 Zero VOC Interior Latex Eggshell Enamel, B20-2600 Series</td>
<td>1.7</td>
<td>0</td>
</tr>
<tr>
<td>Concrete Walls</td>
<td>Gloss</td>
<td>Loxon Concrete and Masonry Primer, B28W8300</td>
<td>3.2</td>
<td>96</td>
<td>All States except CA: 2 Coats: ProMar 200 Interior Latex Gloss Enamel, B21W200 State of CA: 2 Coats: Solo Gloss Low VOC Enamel, B21WJ Series</td>
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<td>143</td>
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<tr>
<td>Concrete Walls</td>
<td>Eggshe...</td>
<td>Loxon Concrete and Masonry Primer, B28W8300</td>
<td>3.2</td>
<td>96</td>
<td>2 Coats: ProMar 200 Zero VOC Interior Latex Eggshell Enamel, B202-2600 Series</td>
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<td>Concrete Masonry Unit</td>
<td>Gloss</td>
<td>PrepRite Block Filler, B25W25</td>
<td>8.0</td>
<td>45</td>
<td>All States except CA: 2 Coats: ProMar 200 Interior Latex Gloss Enamel, B21W200 State of CA: 2 Coats: Solo Gloss Low VOC Enamel, B21WJ Series</td>
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<td>143</td>
</tr>
<tr>
<td>Concrete Masonry</td>
<td>Eggshe...</td>
<td>PrepRite Block Filler, B25W25</td>
<td>8.0</td>
<td>45</td>
<td>2 Coats: ProMar 200 Zero VOC Interior Latex Eggshell</td>
<td>1.7</td>
<td>0</td>
</tr>
<tr>
<td>Surface</td>
<td>Sheen</td>
<td>1st Coat</td>
<td>DFT (mils) (per coat)</td>
<td>VO C (g/l)</td>
<td>2nd and 3rd Coats</td>
<td>DFT (mils) (per coat)</td>
<td>VO C (g/l)</td>
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<tr>
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<td>-----------------------</td>
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<td>-----------------------------------------------------</td>
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<td>------------</td>
</tr>
<tr>
<td>Gypsum Board</td>
<td>Semi-gloss</td>
<td>ProMar 200 Zero VOC Latex Primer, B28W02600</td>
<td>1.5</td>
<td>0</td>
<td>2 Coats: ProMar 200 Zero VOC Interior Latex Semi-Gloss Enamel, B31-2600 Series</td>
<td>1.6</td>
<td>49</td>
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<tr>
<td>Gypsum Board</td>
<td>Egg-shell</td>
<td>ProMar 200 Zero VOC Latex Primer, B28W02600</td>
<td>1.5</td>
<td>0</td>
<td>2 Coats: ProMar 200 Zero VOC Interior Latex Eggshell Enamel, B20-2600 Series</td>
<td>1.7</td>
<td>0</td>
</tr>
<tr>
<td>Wood</td>
<td>Semi-gloss</td>
<td>ProMar 200 Zero VOC Latex Primer, B28W02600</td>
<td>1.5</td>
<td>0</td>
<td>2 Coats: ProMar 200 Zero VOC Interior Latex Semi-Gloss Enamel, B31-2600 Series</td>
<td>1.6</td>
<td>0</td>
</tr>
<tr>
<td>Wood (Transparent sealer (Finish S1))</td>
<td></td>
<td>Wood Classics Varnish Sanding Sealer, B26V43</td>
<td>1.2</td>
<td>522</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Wood (Exposed laminated wood roof structure)</td>
<td>Semi-gloss</td>
<td>PrepRite ProBlock Interior/Exterior Latex Primer Sealer B51 Series</td>
<td>1.4</td>
<td>97</td>
<td>2 Coats: ProMar 200 Zero VOC Interior Latex Semi-Gloss Enamel, B31-2600 Series</td>
<td>1.6</td>
<td>0</td>
</tr>
<tr>
<td>Concrete Floors</td>
<td>Semi-gloss</td>
<td>Macropoxy 646-100, B58W620, B58V620</td>
<td>5.0-10.0</td>
<td>&lt;10</td>
<td>Macropoxy 646-100, B58W620, B58V620</td>
<td>5.0-10.0</td>
<td>&lt;10</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 1 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes toilet compartments and screens as follows:
   1. Type: Phenolic / Polymer Resin.
   2. Compartment Style: Overhead braced and floor anchored.

B. Related Sections include the following:
   1. Division 10 "Toilet Accessories" for toilet paper holders, grab bars, purse shelves, and similar accessories.

1.3 SUBMITTALS

A. Product Data: For each type and style of toilet compartment and screen specified. Include details of construction relative to materials, fabrication, and installation. Include details of anchors, hardware, and fastenings.

B. Shop Drawings: For fabrication and installation of toilet compartment and screen assemblies. Include plans, elevations, sections, details, and attachments to other work.
   1. Show locations of reinforcement and cutouts for compartment-mounted toilet accessories.

C. Samples for Initial Selection: Manufacturer's color charts consisting of sections of actual units showing the full range of colors, textures, and patterns available for each type of compartment or screen indicated.

1.4 PROJECT CONDITIONS

A. Field Measurements: Verify dimensions in areas of installation by field measurements before fabrication and indicate measurements on Shop Drawings. Coordinate fabrication schedule with construction progress to avoid delaying the Work.
   1. Established Dimensions: Where field measurements cannot be made without delaying the Work, establish dimensions and proceed with fabricating units without field measurements. Coordinate supports, adjacent construction, and fixture locations to ensure actual dimensions correspond to established dimensions.

PART 2 - PRODUCTS

2.1 MANUFACTURERS
A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

1. Accurate Partitions Corporation.
2. All American Metal Corp.
3. Ampco Products, Inc.
5. Capitol Partitions, Inc.
7. Compression Polymers Group; Comtec Industries.
8. Crane Plumbing; Sanymetal.
10. Hadrian Inc.
12. Lambaton/Universal.
13. Metpar Corp.
16. Santana Products, Inc.
17. Tex-Lam Manufacturing, Inc.
19. Weis/Robart Partitions, Inc.
20. Young Sales Corp.; DesignRite.

2.2 MATERIALS

A. General: Provide materials that have been selected for surface flatness and smoothness. Exposed surfaces that exhibit pitting, seam marks, roller marks, stains, discolorations, telegraphing of core material, or other imperfections on finished units are unacceptable.

B. Solid-Plastic, Polymer Resin: High-density polyethylene (HDPE) with homogenous color throughout. Provide material not less than 1 inch (25 mm) thick with seamless construction and eased edges in color and pattern as follows:

1. Color and Pattern: One color and pattern in each room as selected by Architect from manufacturer's full range of colors and patterns.

C. Pilaster Shoes and Sleeves (Caps): ASTM A 666, Type 302 or 304 stainless steel, not less than 0.0312 inch (0.8 mm) thick and 3 inches (75 mm) high, finished to match hardware.

1. For solid-plastic, polymer-resin pilasters, stainless-steel pilaster shoes and sleeves to be provided.

D. Stirrup Brackets: Manufacturer's standard ear or U-brackets for attaching panels and screens to walls and pilasters of the following material:


E. Full-Height (Continuous) Brackets: Manufacturer's standard design for attaching panels and screens to walls and pilasters of the following material:

F. Hardware and Accessories: Manufacturer's standard design, heavy-duty operating hardware and accessories of the following material:


G. Overhead Bracing: Manufacturer's standard continuous, extruded-aluminum head rail with antigrip profile in manufacturer's standard finish.

H. Heat-Sink Strip: Manufacturer's standard continuous, extruded-aluminum strip in manufacturer's standard finish.

I. Anchorages and Fasteners: Manufacturer's standard exposed fasteners of stainless steel or chrome-plated steel or brass, finished to match hardware, with theft-resistant-type heads. Provide sex-type bolts for through-bolt applications. For concealed anchors, use hot-dip galvanized or other rust-resistant, protective-coated steel.

2.3 FABRICATION

A. General: Provide standard doors, panels, screens, and pilasters fabricated for compartment system. Provide units with cutouts and drilled holes to receive compartment-mounted hardware, accessories, and grab bars, as indicated.

1. Provide internal reinforcement in metal units for compartment-mounted hardware, accessories, and grab bars, as indicated.

B. Solid-Plastic, Polymer-Resin Compartments and Screens: Provide aluminum heat-sink strips at exposed bottom edges of HDPE units to prevent burning.

C. Overhead-Braced-and-Floor-Anchored Compartments: Provide manufacturer's standard corrosion-resistant supports, leveling mechanism, fasteners, and anchors at pilasters to suit floor conditions. Make provisions for setting and securing continuous head rail at top of each pilaster. Provide shoes at pilasters to conceal supports and leveling mechanism.

D. Wall-Hung Screens: Provide units in sizes indicated of same construction and finish as compartment panels, unless otherwise indicated.

E. Doors: Unless otherwise indicated, provide 24-inch- (610-mm-) wide in-swinging doors for standard toilet compartments.

1. Hinges: Manufacturer's standard self-closing type that can be adjusted to hold door open at any angle up to 90 degrees.
2. Latch and Keeper: Manufacturer's standard surface-mounted latch unit with combination rubber-faced door strike and keeper designed for emergency access. Provide units that comply with accessibility requirements of authorities having jurisdiction at compartments indicated to be handicapped accessible.
3. Coat Hook: Manufacturer's standard combination hook and rubber-tipped bumper, sized to prevent door from hitting compartment-mounted accessories.
4. Door Bumper: Manufacturer's standard rubber-tipped bumpers at out-swinging doors or entrance screen doors.
5. Door Pull: Manufacturer's standard unit that complies with accessibility requirements of authorities having jurisdiction at out-swinging doors. Provide units on both sides of
doors at compartments indicated to be handicapped accessible.

PART 3 - EXECUTION

3.1 INSTALLATION

A. General: Comply with manufacturer's written installation instructions. Install units rigid, straight, plumb, and level. Provide clearances of not more than 1/2 inch (13 mm) between pilasters and panels and not more than 1 inch (25 mm) between panels and walls. Secure units in position with manufacturer's recommended anchoring devices.

B. Overhead-Braced-and-Floor-Anchored Compartments: Secure pilasters to floor and level, plumb, and tighten. Secure continuous head rail to each pilaster with not less than 2 fasteners. Hang doors and adjust so tops of doors are parallel with overhead brace when doors are in closed position.

C. Screens: Attach with anchoring devices according to manufacturer's written instructions and to suit supporting structure. Set units level and plumb and to resist lateral impact.

3.2 ADJUSTING AND CLEANING

A. Hardware Adjustment: Adjust and lubricate hardware according to manufacturer's written instructions for proper operation. Set hinges on in-swinging doors to hold open approximately 30 degrees from closed position when unlatched. Set hinges on out-swinging doors and swing doors in entrance screens to return to fully closed position.

B. Provide final protection and maintain conditions that ensure toilet compartments and screens are without damage or deterioration at the time of Substantial Completion.

END OF SECTION
PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Extruded aluminum, drainable, adjustable louvers.

1.2 REFERENCES

A. The publications listed below form a part of this specification to the extent referenced. Publications are referenced within the text by the basic designation only.

B. Air Movement and Control Association International, Inc. (AMCA):
   1. AMCA 500-L - Laboratory Methods of Testing Louvers for Ratings.

1.3 SUBMITTALS

A. Comply with the requirements of Section 01330.

B. Product Data: Submit manufactures’ product data including performance data.

C. Shop Drawings: Indicate materials, construction, dimensions, accessories and installation details.

1.4 DELIVERY, STORAGE, AND HANDLING

A. Transport, handle, store, and protect products in compliance with the requirements of Section 01600 and manufacturer’s recommendations.

B. Deliver materials to site in manufacturer’s original, unopened containers and packaging with labels clearly indicating manufacturer and material.

C. Store materials in a dry area, protected from damage, in accordance with manufacturer’s instructions.

D. Protect materials and finishes during handling and installation.

PART 2 - PRODUCTS

2.1 DRAINABLE ADJUSTABLE LOUVERS

A. Louvers: Provide the following or approved equivalent
   1. Model No. ELF6375DX by Ruskin, Kansas City, MO (816) 761-7476.

B. Fabrication:
   1. Assembly: Factory assembled louver components.
   2. Frame:
      b. Wall Thickness: 0.081 inch nominal.
      c. Depth: 6 inches.
      d. Integral perimeter flange.
   3. Blades:
      a. Style: drainable, horizontally mounted at 37.5 degrees.
c. Wall Thickness: 0.081 inch nominal.
d. Centers: 6 inches nominal.

5. Linkage: Conceal in frame.
7. Axles: 1/2 inch plated steel hex.
8. Actuator: Electric, 120 V, 60 Hz, two-position, spring-return.
9. Insect/Bird Screen: Provide when and as shown on the drawings.
a. Screen: Aluminum wire.
b. Frame: Aluminum, removable, rewireable.
10. Finish: Factory applied “Kynar” finish. Color to be selected by Architect from a full range of manufacturer’s standard colors.

C. Performance Data:
1. Based on testing a 48 inch by 48 inch size unit in accordance with AMCA 500-L.
2. Free Area: 50 to 55 percent.
3. Static Pressure Loss: Not to exceed 0.12 inch water gauge at an airflow rate of 846 fpm free area intake velocity.
4. Water Penetration: Not to exceed 0.01 oz. per sq. ft. of free air area at a flow rate of 846 fpm free area velocity.

D. Design Load: Provide louvers capable of withstanding the effects of gravity loads and wind loads, as indicated on the Structural Drawings or a minimum windload of 20 psf, acting inward or outward, without permanent deformation of louver components, noise or metal fatigue caused by louver blade rattle or flutter, or permanent damage to fasteners and anchors.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Inspect areas to receive louvers. Do not proceed, if unsatisfactory conditions exist that will not allow for a complete and proper installation. Proceed upon correction.

3.2 INSTALLATION

A. Install in accordance with manufacturer’s instructions. Provide appurtenances required for a complete and proper installation.
B. Install plumb, level, flush, and in alignment with adjacent work.

3.3 CLEANING

A. Remove temporary coverings and protection of adjacent work areas.
B. Clean exposed surfaces that are not protected by temporary covering, to remove fingerprints and soil during construction period. Do not let soil accumulate until final cleaning.
C. Before final inspection, clean exposed surfaces with water and a mild soap or detergent not harmful to finishes. Thoroughly rinse surfaces and dry.
D. Restore items damaged during installation and construction so no evidence remains of corrective work. If results of restoration are unsuccessful as determined by Architect, remove damaged units and replace with new units. Touch up minor abrasions in finishes with air-dried coating that matches color and gloss of, and is compatible with, factory-applied finish coating.

END OF SECTION
PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Aluminum flagpoles.
   2. Flags.

1.2 REFERENCES

A. The publications listed below form a part of this specification to the extent referenced. Publications are referenced within the text by the basic designation only.

B. The Aluminum Association, Inc. (AA):
   1. AA DAF45 – Designation System for Aluminum Finishes

C. ASTM International (ASTM):
   1. ASTM B 221 - Aluminum And Aluminum-Alloy Extruded Bars, Rods, Wire, Profile, And Tubes
   2. ASTM B 917 - Standard Practice For Heat Treatment Of Aluminum-Alloy Castings From All Processes.

D. National Association of Architectural Metal Manufacturing (NAAMM):

1.3 DELIVERY, STORAGE AND HANDLING

A. Transport, handle, store, and protect products in compliance with the requirements of Sections 1600 and manufacturer’s recommendations.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following or approved equal:
   2. Concord Industries, Inc., Dallas, TX (800) 527-3902.
   3. Eder Flagpole Company, Oak Creek, WI (800) 558-6044.

2.2 PERFORMANCE REQUIREMENTS

A. Structural Performance: Provide flagpoles capable of withstanding the effects of wind loads, determined according to NAAMM FP 1001, “Guide Specifications for Design of Metal Flagpoles.”
   1. Flag Size: Design flagpole based upon 4 foot x 6 foot nylon flag.
   2. Basic Wind Speed: Design flagpole based on 90 mph wind speed.

2.3 FLAGPOLES

A. Groundset Flagpoles: Provide cone tapered ground set flagpole fabricated from extruded aluminum tubing complying with ASTM B 221, Alloy 6063, with a minimum wall thickness of 5/32 inch. Heat treat after fabrication to comply with ASTM B 597, Temper T6.
   1. Length: 30'-0” exposed. Overall length shall be as shown to include unexposed portion below ground.
2. Mounting: Ground sleeve type.

2.4 FITTINGS AND ACCESSORIES

A. Finial Ball: Manufacturer's standard flush-seam ball, sized as indicated to match flagpole-butt diameter.
   1. Finish: Gold Anodized.

B. External Halyard: Ball-bearing, non-fouling rotating or stationary truck assembly of cast metal with continuous 5/16-inch-diameter, braided nylon halyard, ground hoisted.

C. Cleats: Cast aluminum 9 inch min. with fasteners.
   1. Finish exposed metal surfaces to match flagpole.

D. Halyard Flag Snaps: Provide two swivel snap hooks per halyard.

E. Cleat Box: Aluminum box with cylinder lock. Provide 2 keys.

F. Mounting Hardware:
   1. Provide ground sleeve assembly including sleeve, centering wedges, collar, ground rod, and other required accessories.

2.5 FINISHES

A. Natural Satin Finish: Provide fine, directional, medium satin polish (AA-M32); buff complying with AA-M20; and seal aluminum surfaces with clear, hard-coat wax.

2.6 FLAGS

A. Provide 6 ft. by 10 ft. nylon American flag with sewn stripes and embroidered stars.

B. Provide 6 ft. by 10 ft. nylon State Of Georgia flag with sewing and embroidering as indicated by Owner.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine areas where flagpoles will be installed. Do not proceed with Work until unsatisfactory conditions have been corrected.

B. Beginning of installation indicates acceptance of existing conditions.

3.2 INSTALLATION

A. Install flagpoles where and as shown and according to manufacturer's written instructions.

B. Install halyard and snaps leaving installation ready for use.

C. Install cleat inside lockable cleat box as shown on drawings.

3.3 FIELD QUALITY CONTROL

A. Inspect flagpole installation, accessory attachment, and vertical alignment.
B. Correct deficiencies in Work which inspection indicates are not in compliance with contract documents.

3.4 ADJUSTING AND CLEANING

A. Clean flagpole surfaces immediately prior to installation.

B. Adjust operating devices for smooth halyard and flag function.

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 1 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes the following types of signs:
   1. Interior panel signs.
   2. Vinyl letting at storefront
   3. Exterior Wall Mounted Signs
   4. Exterior Digital Display Signs

B. Related Sections: The following Sections contain requirements that relate to this Section:
   1. Division 1 Section "Temporary Facilities" for temporary project identification signs.
   2. "Electrical Identification" for labels, tags, and nameplates for electrical equipment.
   3. "Interior Lighting" for illuminated exit signs.
   4. Electrical service and connections for illuminated letters.

1.3 SUBMITTALS

A. General: Submit the following according to the Conditions of the Contract and Division 1 Specification Sections.

B. Product data:
   1. Manufacturer’s signed statement regarding compliance with QUALITY ASSURANCE Article.
   2. Manufacturer's product literature indicating units and designs selected.
   3. Evidence of manufacturer's computerized data retrieval program for tracking of Project for sign typography, message strip requirements and other pertinent data from schedule input to final computerized typography on finished product.
   4. Maintenance data and cleaning requirements for exterior surfaces.
   5. Attachment techniques for specific substrates.

C. Shop drawings:
   1. Indicate materials, sizes, configurations, and applicable substrate mountings (for interior and exterior signs as necessary for application).
   2. Artwork for special graphics, headers.
   3. Signage schedule complete with location of each sign and required copy; include floor plans.

D. Samples: Samples will not be returned for use in Project.
   1. Typography sample for message strips and headers copy.
   3. Exterior signs: Provide full size samples of colors and materials of specific project
requirements.

E. Closeout Submittals:
   1. Furnish appropriate checklist for aiding in reordering after Date of Substantial Completion. Maintain computer schedule program for **five** years for ordering new signage required by Owner.
   2. Furnish one complete SignWord software package Windows 7 or later, in Owner selected format for PC type computer.
   3. Furnish SignWord Color paper system

1.4 QUALITY ASSURANCE

A. Manufacturer:
   1. Work required under this section from manufacturers regularly engaged in work of this magnitude and scope for minimum of five years.
   2. Maintain computer link between schedule input and computerized typography production.

B. Single-Source Responsibility:
   1. For each separate sign type required, obtain signs from one source of a single manufacturer.

C. Design Concept: The Drawings indicate sizes, profiles, and dimensional requirements of signs and are based on the specific types and models indicated.

1.5 PROJECT CONDITIONS

A. Field Measurements: Take field measurements prior to preparation of shop drawings and fabrication to ensure proper fitting. Show recorded measurements on final shop drawings. Coordinate fabrication schedule with construction progress to avoid delay.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   1. Manufacturers of interior signs:
      a. APCO Graphics, Inc. “Elements” Industrial System; 388 Grant Street SE, Atlanta, Georgia, 30312, USA. Phone; (404) 688-9000. Fax; (404) 577-3847.
      b. Other manufacturer's products are acceptable if submitted in accord with Product Options and Substitutions section and are in strict compliance with these specified requirements.
   2. Manufacturers of exterior wall mounted signs:
      a. Clayton Signs, 5198 North Lake Dr. Lake City, GA 30260. Phone 404-361-3800; Fax: 404-361-7038; email: sales@claytonsigns.com
      b. A-Brite Signs, 534 Main Street, Forest Park, GA 30297. Phone 404-963-6462.
      c. Apex Signs & Graphics, 600 N. Main Street, Alpharetta GA 30009. Phone: 678-795-0775.
      e. Other manufacturer's products are acceptable if submitted in accord with Product Options and Substitutions section and are in strict compliance with
these specified requirements

3. Manufacturers of exterior digital display signs:
   a. FAST SIGNS of Atlanta
   b. Clayton Signs, 5198 North Lake Dr. Lake City, GA 30260. Phone 404-361-3800; Fax: 404-361-7038; email: sales@claytonsigns.com
   c. Other manufacturer’s products are acceptable if submitted in accord with Product Options and Substitutions section and are in strict compliance with these specified requirements.

2.2 INTERIOR SIGNAGE

A. Standard Assembly

1. Combination of extruded aluminum components, composite aluminum sheet and injection molded components, creating modular signs with a special, concealed pin lock device to secure a clear cover and/or sign insert material into the frame. Possible sign insert/display combinations include:
   b. ADA (Tactile/Braille) Plaques
   c. ADA Bands (always at the bottom of the sign)
   d. Decorative Metal and/or Wood* Components (always at the bottom of the sign)
   e. Painted Plaques with Silkscreen Printed Graphics

B. Assembly allows for flexibility of size and configuration, providing a modular, vandal-resistant solution for signs ranging from single-insert identification signs to large directories and directional signs.

1. Surface Mounted Signs (Wall or Office Panel):
   a. Attachment to wall surfaces via double-sided vinyl tape or concealed mechanical fasteners.
   b. Attachment to office panels via concealed stainless steel pins or special aluminum or plastic clips.

2. Wall Projection Signs: Combination of two signs attached back-to-back utilizing a modular, extruded aluminum "T" bracket (APCO’s CMT-M component).

3. Ceiling Mounted Signs: Combination of two signs attached back-to-back utilizing an extruded aluminum "T" bracket (APCO’s CMT-M component). For such configurations, the aluminum edge profiles, offered in four different shapes, will be at the top and bottom of the assembly.

C. Inner-Access Assembly

1. Combination of extruded aluminum components, composite aluminum sheet, non-glare acrylic, and injection molded components, creating modular signs to house subsurface paper inserts / digital output displays. Special decorative elements and/or ADA compliant bands may be applied at any position on the surface of the non-glare acrylic, from top to bottom. Subsurface displays are removed by inserting a "Post-It" note, or similar, behind the top portion of the non-glare acrylic, applying pressure and then pulling upward.

D. Dimensional Lettering:

1. APCO-MG-F Series; Metal Graphics – Fabricated. Fabricated metal graphics are ideally suited for bold, deep letter forms
   a. Material Options: Aluminum, Brass, Bronze, Copper, Stainless Steel & Painted Metal
   b. Sizes Range: 3" Up
   c. Thickness Range: 3/8" to 24"
   d. Finishes: Satin #4 & #6, Mirror #8, Chrome Plate, Oxidized, Patinas, Polyurethanes
e. Anodized Clear & Color, Custom Metals, Textures and Patterns.

2. 1-0" high lettering shall read "COLLEGE PARK FIRE STATION #3" Location TBD by Architect

E. Finishes: Colors and Surface Textures: For exposed sign material that requires selection of materials with integral or applied colors, surface textures or other characteristics related to appearance, provide color matches indicated, or if not indicated, as selected by the Architect from the manufacturer's standards.

2.3 VINYL LETTERING AT STOREFRONT

A. 6" High white lettering PSV Graphics (pressure sensitive vinyl) include typestyles, arrows and symbols cut with computerized precision from sheet vinyl applies to storefront glass.

B. Lettering to read "College Park Fire Station #3" w/ College Park Logo.

2.5 EXTERIOR WALL MOUNTED SIGNS

A. Signs types complying with requirements specified on Drawings. Wall mounted signs include signs attached to Monument.

B. Channel Letters:
   1. Non-illuminated plastic channel letters, with anchors to substrate per manufacturers recommendations.
   2. Sizes as indicated on drawings.
   3. Color to be selected by Architect or Owner's Representative from manufacturer's standard colors.

C. Aluminum Letters:
   1. Sizes as indicated on drawings.
   2. Attachments: Provide as recommended by manufacturer for attachment to specific substrate.

2.6 EXTERIOR DIGITAL DISPLAY SIGNS

A. Signs types complying with below requirements.

B. Surface Mounted:
   1. Red/Amber LED sign.
   4. Front ventilation and front serviceable.
   5. Sign display on (1) one side for surface-mount applications.
   6. Size: As indicated on the Drawings
PART 3 - EXECUTION

3.1 INSTALLATION

A. Install signage holders in locations with mounting types indicated in accord with reviewed shop drawings. Square, plumb, and level units.

B. Install inserts not more than 48 hours prior to Date of Substantial Completion complete with correct copy in place. Conform to ADA requirements for tactile graphics signage.

3.2 CLEANING AND PROTECTION

A. After installation, clean soiled sign surfaces according to the manufacturer's instructions. Protect units from damage until acceptance by the Owner.
The next pages contain general signage standards. Coordinate with Integrated Sign Systems and Owner for final layout of each panel sign to be prepared.

**SIGNAGE LEGEND**

1. Required accessible elements shall be identified by the International Symbol of Accessibility at the following locations:
   - Accessible entrances where not all entrances are accessible
   - Accessible rooms where multiple single-user toilets are clustered at a single location
   - Unisex toilet and restrooms
   - Accessible dressing rooms where not all such rooms are accessible

2. Directional signage indicating the route to the nearest like accessible element shall be provided at the following locations. These directional signs shall include the International Symbol of Accessibility:
   - At each separate rest room indicating the location of the nearest unisex toilet

3. Tactile signage shall be located on the wall to the door's latch side at a height of 60' any max to the baseline of the highest tactile character. Signs may be placed on the nearest adjacent wall when there is no wall space on the latch side.

4. Character and symbols of signs shall be in contrast with their background and shall be eggshell, matte, or other non-glare materials or finishes.

5. Accessible signage shall use grade II braille and must comply with ANSI A117.1 Section 703.4
1. The International Symbol of Accessibility shall be the standard used to identify facilities that are accessible to and usable by physically disabled persons as set forth in Title 24 and as specifically required in this section.

2. The International Symbol of Accessibility shall consist of a white house on a blue background. The blue shall be equal to color No. 15000 in Federal Standard 595B.

3. Letters and numbers on signs shall have a width-to-height ratio of between 3:5 and 1:1 and a stroke width-to-height ratio between 1:3 and 1:10.

4. Characters and numbers on signs shall be sized according to the viewing distance from which they are to be read. The minimum height is measured using an upper case character. Lower case characters are permitted for signs suspended or projected above the finish floor in compliance. The minimum character height shall be 2".

5. Characters and symbols shall contrast with their background.

6. When raised characters or symbols are used, they shall conform to the following:
   a. Letters and numbers on signs shall be raised 1/2" minimum and shall be sans-serif uppercase characters accompanied by grade 2 Braille.
   b. Raised characters or symbols shall be a minimum of 3/4" high.
   c. Pictorial, numeric, signs (photogram) shall be accompanied by the equivalent verbal description placed directly below the photogram. The smallest dimension of the photogram shall be a minimum of 6" in height.

7. Contracted grade 2 Braille shall be used whenever Braille symbols are specifically required in other portions of these regulations. Dots shall be 1/16" on center in each cell with 3/16" space between cells. Dots shall be raised a minimum of 1/16" above the background.

8. Men permanent identification is provided for rooms and spaces. Raised letters shall be accompanied by Braille. Signs shall be installed on the wall adjacent to the latch side of the door. Where there is no wall space on the latch side, including double leaf doors, signs shall be placed on the nearest adjacent wall preferably on the right. Mounting height shall be 60" above the finisher floor to the centerline of the sign. Mounting location shall be determined so that a person in a wheelchair will approach within 3" of the sign/age without encountering protruding objects or standing within the swing of a door.
PART 1 GENERAL

1.1 RELATED DOCUMENTS
A. Drawings and general provisions of the Contract, including General and Special Conditions apply to this Section.

1.2 SUMMARY
A. This section includes, but is not limited to:
   1. Fire extinguishers.
   2. Fire extinguisher cabinets.
   3. Accessories.

1.3 RELATED SECTIONS
A. Section 06100 - Rough Carpentry: Wood blocking product and execution requirements.

1.4 REFERENCES

1.5 SUBMITTALS
A. Shop Drawings: Indicate cabinet physical dimensions.
B. Product Data: Provide extinguisher operational features.
C. Manufacturer’s Installation Instructions: Indicate special criteria and wall opening coordination requirements.
D. Maintenance Data: Include test, refill or recharge schedules and re-certification requirements.

1.6 ENVIRONMENTAL REQUIREMENTS
A. Do not install extinguishers when ambient temperature may cause freezing of extinguisher ingredients.

1.7 WARRANTY
A. Provide one year warranty per IBC 2006 requirements
PART 2 PRODUCTS

2.1 FIRE EXTINGUISHERS

A. Fire Extinguishers - General: Comply with product requirements of NFPA 10 and applicable codes, whichever is more stringent.
   1. Provide extinguishers labeled by Underwriters Laboratories Inc. for the purpose specified and indicated.

B. Dry Chemical Type Fire Extinguishers: Stainless steel tank, with pressure gage.
   1. Provide K class at Kitchen. Provide Class B:C at all other locations.
   2. Size 10.
   3. Finish: Baked enamel, red color.

2.2 FIRE EXTINGUISHER CABINETS

A. Metal: Formed primed steel sheet; 0.036 inch (0.9 mm) thick base metal.

B. Cabinet Configuration: Semi-recessed type.
   1. Sized to accommodate accessories.
   2. Exterior and interior nominal dimensions as required to accommodate fire extinguisher.
   3. Trim: Returned to wall surface, with 2-1/2 inch (64 mm) projection, 1-3/4 inch (44 mm) wide face.
   4. Form cabinet enclosure with right angle inside corners and seams. Form perimeter trim and door stiles.

C. Door: 0.036 inch (0.9 mm) thick, reinforced for flatness and rigidity; latch. Hinge doors for 180 degree opening with two butt hinge. Provide nylon catch.

D. Door Glazing: Glass, clear, 1/8 inch (3 mm) thick float. Set in resilient channel gasket glazing.

E. Cabinet Mounting Hardware: Appropriate to cabinet. Pre-drill for anchors.

F. Weld, fill, and grind components smooth.

G. Finish of Cabinet Exterior Trim and Door: Red enamel.

H. Finish of Cabinet Interior: White enamel.

2.3 ACCESSORIES

A. Extinguisher Brackets: Formed steel, chrome-plated.
PART 3 EXECUTION

3.1 EXAMINATION

A. Verify existing conditions before starting work.

B. Verify rough openings for cabinet are correctly sized and located.

3.2 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Install cabinets plumb and level in wall openings, mounting height from finished floor to inside bottom of cabinet, as indicated on drawings or required by governing authority.

C. Secure rigidly in place.

D. Place extinguishers and accessories in cabinets.

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 1 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes the following:

1. Heavy Duty Knocked Down Turnout Lockers

1.3 SUBMITTALS

A. General: Submit each item in this Article according to the Conditions of the Contract and Division 1 Specification Sections.

B. Product Data: Manufacturer's printed data including materials, accessories, construction, finishes, assembly, and installation instructions for lockers and benches.

C. Shop Drawings: Layout and dimensions of metal lockers and benches. Indicate relationship to adjoining surfaces. Show locker elevations and details, fillers, trim, base, sloping tops, and accessories. Include locker numbering sequence. Indicate installation and anchorage requirements.

D. Samples for Initial Color Selection: Manufacturer's color charts showing a full range of available colors.

E. Samples for Color Verification: Samples showing actual colors prepared on same material to be used for the Work.

F. Maintenance Instructions: Instructions for cleaning lockers and for adjusting, repairing, and replacing locker doors and latching mechanisms.

1.4 QUALITY ASSURANCE

A. Single-Source Responsibility: Obtain locker units and accessories from one manufacturer.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Do not deliver lockers until spaces to receive them are clean, dry, and ready for locker installation.

B. Protect lockers from damage during delivery, handling, storage, and installation.

C. Deliver master keys, control keys, and combination control charts to Owner.

PART 2 - PRODUCTS
2.1 MANUFACTURERS

A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated in the Work include, but are not limited to, the following:

2. Art Metal Products, Div. of Fort Knox Storage Co.
4. Hadrian Inc.
5. The Interior Steel Equipment Co.
6. List Industries Inc.
7. Lyon Metal Products Inc.
8. Medart, Inc.
11. Steiner Company, Inc.
12. Tiffin Metal Products Co.

B. Provide Penco Patriot Turnout Lock, Model No. 6KTDA02 or approved equivalent

1. Size: 24"x24"x72"

2.2 MATERIALS

A. Steel Sheet: Commercial-quality, prime grade mild cold-rolled steel sheet, stretcher leveled, free of buckling, scale, and surface imperfections, capable of taking high-grade enamel finish and in compliance with ASTM A 1008.

B. Fasteners: Zinc- or nickel-plated steel; slotless-type exposed bolt heads; self-locking nuts or lock washers for nuts on moving parts.

C. Equipment: Manufacturer's standard plated steel coat rods.

2.3 HEAVY DUTY KNOCKDOWN TURNOUT LOCKERS

A. Heavy Duty Lockers: All locker body components made of cold rolled steel specially formed for added strength and rigidity and to ensure tight joints at fastening points.

B. Locker Body Construction: Steel specially formed for added strength and rigidity and to ensure tight joints at fastening points.

1. Sides, Bottoms, Tops, and Shelves:
   a. 16 gauge steel.
   b. Sheet steel sides ventilated with 3/4 inch (19 mm) wide by 1-1/2 inch (38 mm) high diamond-shaped perforations unless specified solid.


3. Tops and bottoms with three sides formed 90 degrees, the front offset formed to be flush with horizontal frame member.

4. Shelves with four sides formed to 90 degrees, front edge having a second bend.

5. Vertical frame member to be not less than 16 gauge formed to a channel shape.
and hemmed to create a smooth interior edge. Intermembering parts to be mortised and tenoned and electrically welded together in a rigid assembly capable of resisting strains.

6. Hole Spacing in Locker Body Construction: Not exceeding 9 inches (225 mm).

7. Optional factory assembly locker bodies using rivets.

2.4 LOCKER ACCESSORIES

A. Equipment: Furnish each locker with the following items, unless otherwise shown:

1. Single-Tier Units: 1 double-prong ceiling hook, and not fewer than 2 single-prong wall hooks.
2. Shelf: Appropriate 12 inches below top of locker.
3. Hooks: Two heavy duty 7/8 inches 2 ½”x3” single prong wall hook.
4. Coat Rod: One 1 inch diameter coat rod.

B. Number Plates: Manufacturer's standard etched, embossed, or stamped, nonferrous-metal number plates with numerals not less than 3/8 inch (9 mm) high. Number lockers in sequence indicated. Attach plates to each locker door, near top, centered, with at least 2 fasteners of same finish as number plate.

C. Recess Trim: Manufacturer's standard 18 gauge steel, 3-inch (75mm) minimum face dimensions with concealed fastening clips.

E. Front Fillers: 20 gauge steel formed in an angle shape, with 20 gauge slip joint angles formed in an angle shape with double bend on one leg forming a pocket to provide adjustable mating with angle filler.
1. Attachment by means of concealed fasteners.
2. Finish to match lockers.

F. Finished End Panels: Minimum 16 gauge steel formed to match locker depth and height, 1 inch (25 mm) edge dimension; finish to match lockers. Install with concealed fasteners.

G. Continuous sloped hoods: 16 gauge steel, slope rise equal to 1/3 of the locker depth (18.5 degrees), plus a 1 inch (25 mm) vertical rise at front.
1. Supplied in 72 inch (1829 mm) lengths only.
2. Slip joints without visible fasteners at splice locations.
3. Provide necessary end closures.
4. Finish to match lockers.

2.5 FABRICATION

A. Fabricate lockers square, rigid, and without warp, with metal faces flat and free of dents or distortion. Fabricate on the unit principle, each locker with individual frame, individual top, bottom, back, and shelves, with common intermediate divisions separating compartments. Verify dimensions and arrangement before fabrication.

1. Form locker body panels, doors, shelves and accessories from 1-piece steel sheet unless otherwise indicated.
2. Preassemble lockers by welding all joints, seams, and connections. Grind exposed welds flush.
2.6  FINISHES, GENERAL

A. Comply with NAAMM "Metal Finishes Manual" for recommendations relative to applying and designating finishes.

B. Finish all steel surfaces and accessories, except prefinished stainless-steel and chrome-plated surfaces.

C. Protect mechanical finishes on exposed surfaces from damage by applying strippable, temporary protective covering prior to shipment.

D. Appearance of Finished Work: Variations in appearance of abutting or adjacent pieces are acceptable if they are within 1/2 of the range of approved samples. Noticeable variations in the same piece are not acceptable. Variations in appearance of other components are acceptable if they are within the range of approved samples and they are assembled or installed to minimize contrast.

2.7  STEEL SHEET FINISHES

A. Surface Preparation: Solvent-clean surfaces complying with SSPC-SP 1 to remove dirt, oil, grease, and other contaminants that could impair paint bond. Remove mill scale and rust, if present, from uncoated steel complying with SSPC-SP 5 (White Metal Blast Cleaning) or SSPC-SP 8 (Pickling), and phosphatize surfaces.

B. Powder Coat Finish: High grade enamel powder coat finish applied per manufacturer's specifications, free of VOC's. Thickness shall be a minimum of 1 mil dry film.

1. Color and Gloss: As selected by Architect from manufacturer's full range of choices for color and gloss.

PART 3 - EXECUTION

3.1  INSTALLATION

A. Install metal lockers complete with accessories according to manufacturer's recommendations. Install plumb, level, rigid, and flush.

B. Assemble knock-down lockers with standard fasteners according to manufacturer's recommendations with no exposed fasteners on door faces and face frames.

C. Connect together welded locker groups with standard fasteners according to manufacturer's recommendations, with no exposed fasteners on face frames.

D. Anchor lockers to floors and walls at intervals recommended by manufacturer but no greater than 36 inches (910 mm). Install anchors through back-up reinforcing plates where necessary to avoid metal distortion, using concealed fasteners.

E. Install recess trim to recessed lockers using concealed fasteners. Provide hairline joints and concealed splice plates.
F. Install sloping top units to lockers using concealed fasteners. Provide hairline joints and concealed splice plates.

G. Install boxed end panels to conceal exposed ends of nonrecessed lockers.

H. Install finished end panels to conceal exposed ends of nonrecessed lockers.

3.2 ADJUSTING, CLEANING, AND PROTECTION

A. Adjust doors and latches to operate easily without binding. Verify that integral locking devices are operating properly.

B. Clean interior and exposed exterior surfaces and polish stainless-steel and nonferrous metal surfaces.

C. Protect lockers from damage, abuse, dust, dirt, stain, or paint. Do not permit locker use during construction.

D. Touch up marred finishes, or replace locker units that cannot be restored to factory-finished appearance. Use only materials and procedures recommended or furnished by locker manufacturer.

END OF SECTION
PART 1 - GENERAL

1.1 SUMMARY:
A. Related work specified elsewhere:
   1. Gypsum Board Assemblies.
   2. Toilet compartments.

1.2 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.
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.

1.3 JOB 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.

1.4 DESIGN CRITERIA
A. In order to be acceptable, products shall comply with the following criteria:
   1. All accessories shall be products of a single manufacturer.
   2. Keying: Keyed accessories shall be keyed alike, unless otherwise specified.
   3. 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.

1.5 WARRANTY:
A. Mirrors: Warrant mirrors for fifteen years against silver spoilage.

PART 2 - PRODUCTS

2.1 TOILET ACCESSORIES:
A. Acceptable manufacturers; subject to compliance with specified design criteria:
   1. Bobrick Washroom Equipment, Inc. or approved equal (see drawings).

B. Pipe Insulation; premoulded PVC insulating covers for drain and supply lines:
   2. Truebro, Inc., Handi Lay—Guard
   3. Approved equal
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.

C. Grab bars:
   1. Attach grab bars to masonry walls using 114" diameter stainless steel toggle bolts.
   2. 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.

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.

END OF SECTION 10800
PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Residential Kitchen Appliances.
   2. Commercial Laundry Appliances.
   3. Commercial Kitchen Appliances and fixtures
   4. Miscellaneous Other Product Used.

1.2 SUBMITTALS

A. Section 01330 - Submittals: Procedures for submittals. Submit required submittals within 30 days after contract award.

B. Product Data: Submit manufacturer’s specifications and installation instructions.

C. Certifications: Provide Energy Star certification for all appliances in this section.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following or approved equal:
   1. General Electric
   2. KitchenAid
   3. Continental
   4. Elkay
   5. Bloomfield
   6. Vulcan
   7. Regency
   8. Larkin
   9. Ice-O-Matic
   10. Kraus
   11. InSinkErator

2.2 RESIDENTIAL KITCHEN APPLIANCES

A. Microwave: 2.0 cu.ft. Countertop (stainless color) by GE Model JES2051DN/SN or approved equivalent.

B. Garbage Disposal: 1/2 HP food waste disposer by InSinkErator model No. Badger 5 or approved equivalent.

C. Dishwasher: GE Profile by General Electric No. PDT825SSJSS or approved equivalent.

D. Coffee Maker: 2-Warmer In-Line Automatic Coffee Brewer by Bloomfield Model 8540 or approved equivalent.

E. Vent Hood: 54" Convertible Under-Cabinet Hood (stainless steel) by Larkin Model No. SS or approved equivalent

2.3 COMMERCIAL LAUNDRY APPLIANCES
A. Washer Extractor: 40 lb capacity high performance by Continental Model No. EM025 or approved equivalent, with 8" base.

B. Dryer: 40 lb capacity high performance by Continental Model No KFE/KFG or approved equivalent.

2.4 COMMERCIAL KITCHEN APPLIANCES AND FIXTURES

A. Range: 48" electric range by Vulcan Model EV48S-8FP208 or approved equivalent.

B. Refrigerator: GE Profile Series 24.6 cu. Ft Top-Freezer Refrigerator with Internal Water Dispenser by General Electric Model No. PTS25SHS or approved equivalent.

C. Sink: Elkay SSP 14" Deep Two Compartment Stainless Steel Sink model 14-2C16x20-OX or approved equivalent

D. Sink faucet: wall mounted swivel with 8” center and 12” swing spout by Regency Model No 600FW812 or approved equivalent.

E. Ice Maker: 22" Freestanding (stainless color) by Ice-O-Matic Model No. ICE0520/0525 or approved equivalent.

F. Table: 30”x72” Stainless Steel commercial work table with galvanized legs, overhead pot rack and undershelf.

2.5 MISCELLANEOUS OTHER PRODUCTS USED

A. Splash Guard: 22 gauge stainless steel sheet metal, cut to fit, with smooth edges. Provide where indicated on drawings.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine areas where appliances will be installed. Do not proceed with Work until unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Install appliances where and as shown and according to manufacturer’s written instructions.

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 1 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes venetian blinds.

1.3 SUBMITTALS

A. General: Submit each item in this Article according to the Conditions of the Contract and Division 1 Specification Sections.

B. Product data for each type of horizontal louver blind specified. Include printed data on physical characteristics.

C. Shop drawings showing location and extent of blinds. Show installation details at and relationship to adjoining work. Include elevations indicating blind units. Indicate location of blind controls.

D. Samples for initial selection in the form of manufacturer's color charts showing the full range of colors, textures, and patterns available for each type of horizontal louver blind indicated.

E. Samples for verification of the following products, in manufacturer's standard sizes, showing the full range of color, texture, and pattern variations expected. Prepare samples from the same material to be used for the Work.
   1. Louver: Manufacturer's standard-size unit, not less than 12 inches (300 mm) long.
   2. Valance: Manufacturer's standard-size unit, not less than 12 inches (300 mm) long.

F. Schedule of horizontal louver blinds using same room designations indicated on Drawings.

G. Maintenance data for horizontal louver blinds to include in the operation and maintenance manual specified in Division 1. Include the following:
   1. Methods for maintaining horizontal louver blinds and finishes.
   2. Precautions for cleaning materials and methods that could be detrimental to finishes and performance.

1.4 QUALITY ASSURANCE

A. Fire-Test-Response Characteristics: Provide horizontal louver blinds identical to those tested for the following fire-test-response characteristics as determined by UL or another testing and inspecting agency acceptable to authorities having jurisdiction.

B. Single-Source Responsibility: Obtain each type of horizontal louver blind from one source and by a single manufacturer.
1.5 PROJECT CONDITIONS

A. Field Measurements: Check actual horizontal louver blind dimensions by accurate field measurements before fabrication, and show recorded measurements on final shop drawings. Coordinate fabrication schedule with construction progress to avoid delaying the Work.

B. Space Enclosure and Environmental Limitations: Do not install horizontal louver blinds until space is enclosed and weatherproof, wet-work in space is completed and nominally dry, work above ceilings is complete, and ambient temperature and humidity conditions are and will be continuously maintained at values near those indicated for final occupancy.

1.6 EXTRA MATERIALS

A. Furnish extra materials described below that match products installed, are packaged with protective covering for storage, and are identified with labels clearly describing contents.

1. Horizontal Louver Blinds: Before installation begins, furnish quantity of full-size units equal to 5 percent of amount of each size installed.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated in the Work include, but are not limited to, the following:

B. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Horizontal Louver Blinds:

   a. Eastern Standard Corp.
   b. Faber.
   c. Hunter Douglas, Inc.
   d. Joanna Western Mills Co.
   e. Kirsch.
   f. Levolor Corp.
   g. Louverdrape, Inc.
   h. Nanik.
   i. Springs Window Fashions Division, Inc.; (Bali-Graber).
   j. Verosol USA, Inc.
   K Or Equal

2.2 HORIZONTAL LOUVER BLINDS

A. Louvers: Manufacturer's standard as follows:

1. Aluminum.

   a. Perforated: Openness factor of 6 percent.

2. Nominal Louver Width: 1 inch (25 mm) (miniblinds).

C. Cord-Lock Operation: Cord lock; locks pull cord to stop blind at any position in ascending or descending travel.

D. Cord Equalizers: Self-aligning to maintain horizontal louver blind position.

E. Valance: Match color of louvers.

F. Mounting: As indicated.

G. Colors and Patterns: Where manufacturer's standard products are indicated, provide horizontal louvers complying with the following requirements:

1. Provide Architect's selections from manufacturer's full range of colors and patterns for horizontal louver blinds of type indicated.

2.3 FABRICATION

A. Product Standard and Description: Comply with AWCMA Document 1029 for each horizontal louver blind unit consisting of louvers, rails, cord locks, tilting mechanisms, tapes, and installation hardware.


C. Unit Sizes: Obtain units fabricated in sizes to fill window and other openings as follows, measured at 74 deg F (23 deg C):

1. Blind Units Installed Between (Inside) Jambs: Width equal to 1/4 inch (6 mm) per side or 1/2 inch (12 mm) total, plus or minus 1/8 inch (3 mm), less than jamb to jamb dimension of opening in which each blind is installed. Length equal to 1/4 inch (6 mm), plus or minus 1/8 inch (3 mm), less than head to sill dimension of opening in which each blind is installed.

2. Blind Units Installed Outside Jambs: Width and length as indicated, with terminations between blinds of end-to-end installations at centerlines of mullion or other defined vertical separations between openings.

D. Electric Motors: UL-approved, low-voltage motor with thermal overload switch; sized by blind manufacturer for installation indicated.

E. Installation Fasteners: Not less than 2 fasteners per bracket, fabricated from metal noncorrosive to blind hardware and adjoining construction; support blind units under conditions of normal use.

F. Hold-Down Brackets: Manufacturer's standard, as indicated.

G. Side Channels: Manufacturer's standard, as indicated.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions for compliance with requirements for installation
tolerances and other conditions affecting performance of horizontal louver blinds. Do not proceed with installation until unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Install blinds level, plumb, and located so exterior louver edges in any position are not closer than 1 inch (25 mm) to interior face of glass lites.

1. Flush Mounted: Install blinds with louver edges flush with finish face of wall.

3.3 ADJUSTING

A. Adjust components and accessories for proper operation.

3.4 CLEANING

A. Clean blind surfaces, according to manufacturer’s instructions, after installation.

B. Remove surplus materials, packaging, rubbish, and debris resulting from installation. Leave installation areas neat, clean, and ready for use.

3.5 PROTECTION

A. Provide final protection and maintain conditions in a manner acceptable to manufacturer and installer that ensure that horizontal louver blinds are without damage or deterioration at the time of Substantial Completion.

END OF SECTION
PART 1 - GENERAL

1.1 GENERAL REQUIREMENTS

A. Refer to Division 1 - General Requirements and any and all Supplementary or Special Requirements, all of which apply to work described in Division 15 - HVAC as if written in full herein.

B. The scope of work described in these Specifications and/or indicated on the Drawings shall include the furnishing of all materials, equipment, appurtenances, accessories, connections, labor, etc. required and/or necessary to completely install, clean, inspect, adjust, test, balance and leave in safe and proper operating condition all HVAC systems. All HVAC work shall be accomplished by workmen skilled in the various trades involved.

C. The Drawings and Specifications are complementary to each other and what is called for by one shall be as binding as if called for by both. If a discrepancy exists between the Drawings and Specifications, the higher implied cost shall be included in the bid, and the Architect shall be notified of the discrepancy in writing.

D. All work performed under this specification shall be accomplished in accordance with the requirements and provisions of the following sections:

1.2 CODES AND STANDARDS

A. All HVAC work shall conform to all ordinances and regulations of the City, County and State where the work will take place, including the requirements of all authorities having jurisdiction. The following codes, standards and references shall be observed as a minimum:

1. The 2012 International Codes
2. State Amendments to the Code
3. National Fire Protection Association (NFPA) Standards and Guidelines
4. Local and State Fire Marshal requirements
5. Local Building and Inspection Department requirements
6. American Society of Heating, Refrigerating and Air Conditioning Engineers, Inc. (ASHRAE)
   d. Other Standards and Guidelines as applicable
7. Sheet Metal and Air Conditioning Contractors’ National Association, Inc. (SMACNA) Manuals
8. Underwriters Laboratories Inc. (UL)
9. Americans with Disabilities Act (ADA)

B. If Code or other requirements exceed the provisions shown on the Contract Documents, the Engineer shall be notified in writing. Where requirements of the Contract Documents exceed Code requirements, work shall be furnished and installed in accordance with the
1.3 **WORK INCLUDED**

The HVAC Systems installed and work performed under this Division of the Specifications shall include, but not necessarily be limited to:

A. **Airside Systems**
   1. Equipment: including fans, unitary air conditioners, air handling units, fan-coil units, make-up air units, dedicated outdoor air units, furnaces, split systems, etc.
   2. Ductwork and Accessories: including sheet metal, duct-board, kitchen hood and dishwasher exhausts, flexible ductwork, fire and smoke dampers, access doors, etc.
   3. Air Terminal Devices: including powered induction units, variable air volume valves, etc.
   4. Air Distribution Devices: including louvers, registers, grilles, diffusers, etc.

B. **Refrigerant and Water Systems**
   1. Equipment: including pumps, air separators, expansion tanks, water chillers, cooling towers, heat exchangers, boilers and space heating water heaters, feed-water systems, condensing units, etc.
   2. Piping, Tubing and Accessories: including pipe, refrigerant tubing, valves, solenoids, thermal expansion valves, strainers, air vents, pipe and equipment drains, condensate drains, etc.

C. **Equipment, Ductwork and Piping Supports**
   1. Equipment Mounts: including roof curbs, concrete housekeeping pads, equipment rails, miscellaneous steel, etc.
   2. Hangers and Support Devices: including inserts, hanger rods, unistrut, cross-bracing, anchor bolts, pipe anchors, restraints, etc.
   3. Vibration Isolation and seismic restraint: including inertia bases, flexible couplings, expansion devices, snubbers, springs, waffle pads, seismic restraints, etc.

D. **Insulation**
   1. Ductwork Insulation: including exterior duct wrap, internal duct liner, fire wrap, etc.
   2. Piping and Equipment Insulation: including preformed, board and wrap.

E. **Miscellaneous HVAC Equipment**: Unit heaters, wall heaters, roof hoods, heat tracing, etc.

F. **Automatic Temperature Controls**
   1. Decentralized: including all thermostats, control dampers, control valves, programmable controllers, line and low-voltage wiring, smoke detectors, pressure sensors, gas sensors, control logic, etc.
   2. Building Automation System (BAS): same as above but networked to a central human-machine computer interface, including all software and programming, display graphics, etc.
G. Labor and Equipment: including project management, supervision, tradesmen, lifts, forklifts, cranes, scaffolding, saws, wrenches, etc.

H. Equipment and Valve Identification

I. Start-up and Commissioning

J. Demonstration and Owner Training

K. Testing, Adjusting and Balancing

1.4 ENGINEER'S DRAWINGS

A. The locations, arrangement and extent of equipment, devices, ductwork, piping, and other appurtenances related to the installation of the HVAC work shown on the Drawings are approximate and define the intent of the design. The Contractor shall not scale Engineer's Drawings, but shall refer to the architectural drawings for exact dimensions of building components. Should a conflict exist between the architectural and engineering drawings regarding dimensions and scale, the Contractor shall notify the Architect of the discrepancy.

B. Materials, equipment or labor not indicated but which can be reasonably inferred to be necessary for a complete installation shall be provided. Drawings and Specifications do not undertake to indicate every item of material, equipment, or labor required to produce a complete and properly operating installation.

1.5 EQUIPMENT, MATERIALS AND BID BASIS

A. Manufacturers’ names, model numbers, etc. cited on the Drawings and in the Specifications are for the purpose of describing type, capacity, function and quality of equipment and materials required. All project design and coordination between disciplines has been performed as if the named manufacturer and specific piece of equipment will be provided to the project by the Contractor.

B. Alternate equipment and/or materials other than that named on the Drawings and in the Specifications may be proposed for use, but all equipment and materials shall conform entirely to the specified base items. Proposed alternate equipment shall be substantially equal in size, weight, construction and capacity. Alternate equipment and materials shall be submitted only as full equivalent to the equipment and materials specified, with sufficient supportive documentation and technical literature to demonstrate quality, performance, and workmanship without doubt or question. Requests for prior approval of alternate products shall be made at least ten (10) days prior to the bid date and as required by Division 1 - General Requirements. The Engineer shall consider the use of the alternate equipment based on the supportive documentation made available to him, and shall approve or disapprove any proposed alternates. The decision of the Engineer shall, in all cases, be final.

C. The Contractor shall coordinate the installation of all HVAC equipment proposed for use in this project with all building trades (architectural, structural, electrical, etc.). Coordination shall be accomplished prior to, and shall be reflected in, the equipment submittals for approval. When the Contractor requests substitution of alternate equipment, it is with the knowledge that he shall be responsible for any and all costs required by the substitution, including necessary engineering and construction revisions.
in his or any other contract or trade to satisfy the design intent shown on the Plans and described in the Specifications.

D. All materials exposed within HVAC plenums shall have a flame-spread index of not more than 25 and a smoke-developed rating index of not more than 50 unless otherwise allowed by code.

1.6 SUBMITTALS

A. The Contractor shall prepare, submit and obtain Engineer’s review of all manufacturers’ data on the HVAC equipment and systems prior to ordering, purchasing or installing any equipment or materials. Six (6) hard copies of the complete submittal are required, five of which will be reviewed and returned by the engineer. Electronic submittals (e.g. .pdfs, etc.) may be acceptable, if approved by the architect and described in Division 1 - General Requirements. All submittals shall be transmitted simultaneously in hard ring binders (or in a single .zip file), with the associated specification sections cited and the items submitted clearly identified. Partial submittals will be returned without review. Submittals, as a minimum, shall include:

1. All HVAC items scheduled on the Drawings
2. Equipment arrangement, ductwork and piping drawings. Contractor drawings shall be prepared at a minimum scale of 1/8" = 1'-0". A scale of 1/4" = 1'-0" scale is preferred. Drawings shall be indicative of actual equipment purchased and shall show all offsets, transitions, fittings, dampers, valves, hanger locations, etc. Sections are required in spatially tight areas (e.g. kitchens, laundries, central plants, mechanical rooms, etc.) The following will guide the Contractor as to minimum drawing detail required:

a. Clearly indicate top and bottom of duct and pipe elevations. All elevations shall be coordinated as to not conflict with structural, plumbing, electrical and architectural trades.

b. Indicate all offsets (both vertical and horizontal).

c. Indicate graphically all duct and pipe joints and their lengths.

d. Submit duct and pipe-work fabrication schedule indicating duct size range with minimum duct material gauges, pipe schedule being used, duct and pipe connection joint types, section lengths, duct reinforcement type and spacing, etc.

e. Indicate graphically all ductwork to be fabricated with internal duct liner.

f. Indicate all insulation for ductwork and piping.

g. Indicate all dampers and valves as shown on design documents and called for in the specifications.

h. Indicate all flexible connectors where required by specifications and notes.

3. Flexible ductwork, duct-board, insulation and linings
4. Dampers, louvers, air distribution devices
5. Manufacturer’s cut sheets of all piping and tubing materials
6. Where split systems are used in a “long line application,” submit manufacturer’s refrigerant line set routing drawings and engineered calculations supporting the recommended suction and liquid line sizes. Identify and provide cut sheets of any and all accessories required to make the system complete, functional and reliable.

7. Refrigerant type and charge (lbs.) for each item of equipment utilizing refrigerant.
8. Valves, thermometers, pressure gauges
9. Roof curbs, equipment supports, hanger systems, vibration isolators, seismic restraints
10. Control equipment, systems and diagrams
11. Test and balance reports

B. All submittal approvals required by any code or enforcement authority, insurance underwriter, etc. shall be obtained prior to being submitted to the Engineer.

C. Review of submittals by the Engineer does not relieve the Contractor from responsibility for complying with all requirements of the Contract Documents. Furthermore, it shall be the responsibility of the Contractor to coordinate the requirements (roof penetrations, wall penetrations, floor penetrations, curbs, electrical, etc.) of all approved equipment with the other trades and disciplines.

D. All submittals shall be identified by the equipment mark or tag identification numbers shown on the Contract Drawings. Each individual submittal item shall be marked to show which specification section pertains to the item.

E. The Contractor shall provide a written statement confirming coordination of voltage requirements for all HVAC equipment requiring an electrical connection. Statement shall bear the names and signatures of the HVAC and electrical contractors. A photocopied reproduction of the below statement is acceptable.

**VOLTAGE COORDINATION STATEMENT**

This statement is to confirm that the voltages of the equipment provided under this specification have been coordinated with the Electrical Drawings, as well as with the Electrical Contractor.

HVAC Contractor: ________________________________
Project Manager Name: ___________________________
Project Manager Signature/Date: ___________________

Electrical Contractor: ____________________________
Project Manager Name: ___________________________
Project Manager Signature/Date: ___________________

F. Provide Material Safety Data Sheet (MSDS) or letter from manufacturer certifying the VOC content for each adhesive, sealant, paint and coating.

G. VOC Content: Submit adhesive and sealants product information or MSDS showing VOC Content information for all applicable products specified under this section. All applicable products in this section must meet low VOC content as specified by LEED Specification Section 01 81 13 Sustainable Design Requirements.

1.7 PERMITS

A. The Contractor shall obtain all permits and inspections required for the installation of the HVAC work and pay all charges incident thereto. He shall deliver copies of all certificates of permit and inspection to the Architect.
1.8 COORDINATION OF TRADES

A. The Contractor shall give full cooperation to other trades, and shall furnish all information necessary to permit the work of all trades to be installed satisfactorily and with the least possible interference or delay.

B. Piping and other HVAC equipment shall not be installed without first coordinating the installation of same with other trades. The Contractor, at his own expense, shall relocate all uncoordinated ductwork, piping and other HVAC equipment installed should they interfere with the proper installation and mounting of electrical, plumbing equipment, ceilings and other architectural or structural finishes.

C. The Contractor shall coordinate the elevations of all ductwork, piping and equipment above ceilings and in exposed areas with the work of all other disciplines prior to installation.

D. In areas where more than one trade is required to use common openings in beams, joists, chases, shafts and sleeves for the passage of conduits, raceways, piping, ductwork and other materials, the Contractor must coordinate the positions of all piping and equipment to be furnished under this section so that all items including the materials and equipment of other trades may be accommodated within the space available.

E. The HVAC Contractor shall confirm that his work does not interfere with the clearances required for finished columns, pilasters, partitions, walls or other architectural or structural elements as shown on the Contract Documents.

F. Work that is installed under this Contract which interferes with the architectural design or building structure shall be removed and relocated as required at no additional cost to the Contract.

1.9 OPERATION AND MAINTENANCE MANUALS

A. The Contractor shall prepare a minimum of two (2) instruction manuals, one of which shall be submitted to the Architect for the Engineer’s review. Manuals shall describe installation, operation and maintenance of all HVAC equipment and shall include copies of control schematics, sequences of operation, function and operations of all components, as well as the Contractor’s name, address, and telephone number. Manuals shall also contain one copy of all manufacturers’ drawings, pamphlets, data, parts lists, and instruction manual for each piece of equipment. Upon approval, one copy shall be delivered to the Owner; one copy shall be kept by the Contractor. The pamphlets and drawings are to be neatly bound in (a) 3-ring binder(s).

1.10 AS-BUILT DRAWINGS

A. The Contractor shall maintain a record of all changes in the work from that shown in the Contract Documents. The record shall be by red-line mark-up on the most current set of Engineer’s Drawings kept in the field office. After all work is completed, the Contractor shall prepare a set of “as-built” reproducible drawings of similar type and quality as the Engineer’s Drawings. As-built drawings shall accurately depict actual final arrangement of all HVAC items. As-built drawings shall be delivered to the Architect.
1.11 WARRANTY

A. All equipment furnished and installed under this Contract shall be provided with the manufacturer’s standard warranty unless otherwise noted.

B. All reciprocating and scroll air conditioning compressors shall be provided with an extended 5-year parts warranty.

C. The Contractor shall make good all defects in material, equipment, or workmanship disclosed within a period of one (1) year from the date of building acceptance by the Owner. The phrase “make good” shall mean to furnish promptly, without charge, all work necessary to remedy the defects to the satisfaction of the Engineer.

PART 2 - PRODUCTS

2.1 GENERAL

A. All equipment, materials, accessories, etc. used shall be new and of current production unless specified otherwise. Equipment not specified in the Engineer’s Drawings shall be suitable for the intended use and shall be subject to approval by the Engineer.

B. All equipment, products and materials shall be free of defects and shall be constructed to operate in a safe manner without excessive noise, vibration, leakage, or wear.

C. All equipment shall bear the inspection Label of Underwriters Laboratories Inc.

D. All equipment and material for similar applications or systems shall be provided from the same manufacturer unless noted otherwise.

E. The VOC content of all products in this section shall not exceed the VOC limits established in Section 01 81 13 Sustainable Design Requirements.

F. VOC Content: Submit adhesive and sealants product information or MSDS showing VOC Content information for all applicable products specified under this section. All applicable products in this section must meet low VOC content as specified by LEED Specification Section 01 81 13 Sustainable Design Requirements.

2.2 ELECTRICAL WORK

A. Except as otherwise specified or noted, electrical equipment used for HVAC systems shall be as specified herein.

B. Motor controls, system controls, starters, disconnects, pilot lights, push buttons, etc. shall be furnished by the HVAC Contractor compatible with the apparatus that it operates. Electrical equipment shall be wired for the voltage shown on the Electrical Engineer’s Drawings.

C. Electric motors shall be high efficiency, open drip-proof type unless otherwise specified. Motors shall be standard NEMA continuous duty type and shall bear the UL Label. Motors shall be selected with a minimum of 15% safety factor greater than the fan brake/horsepower (e.g. 4.75 BHP would require a nominal 7-1/2 HP motor). The motor
service factor shall not be used as part of the safety factor. All motors shall have thermal overload protection. Motors shall meet Table MG-1-12C of EPACT 1992.

D. Motors controlled by a variable frequency drive (VFD) shall be inverter duty rated and fully compatible with the VFD provided.

E. Starters for motors 1/3 HP and smaller shall be manual type, and for 1/2 HP and larger, shall be magnetic type. Starters shall be minimum size 0, combination type (with disconnect and lockable handle) with molded case circuit breaker. Starters for motors with remote or automatic control shall be magnetic. Relays, interlocks and auxiliary contacts shall be provided as specified and required.

F. Magnetic motor starters shall be across-the-line, full voltage, non-reversing type unless otherwise indicated on the Drawings or specified herein. Starters for motors 75 HP and greater shall be solid state, reduced voltage type.

G. Motor controls shall be either “Hand-Off-Auto” switches or “On-Off” push buttons with one indicating light. “Hand-Off-Auto” switches shall be provided for automatically controlled apparatus.

H. Motor starters that are not an integral part of HVAC equipment shall be installed in conformance with Division 16 - Electrical requirements.

I. All "loose" disconnects and starters shall be installed by Division 16.

J. Power wiring to disconnects, starters, and equipment shall be provided and installed by Division 16. All equipment requiring electrical power shall be provided with disconnect switches at each piece of equipment. Coordinate switch type (fused or non-fused) with equipment characteristics, manufacturer's recommendations and electrical drawings.

K. The Contractor shall provide all system controls, control and interlock wiring 120 volts and less in conduits and in accordance with materials and installation requirements of Division 16 - Electrical.

L. All starters shall be labeled on the face of the starter with a semi-rigid plastic laminate nameplate with 1" high white letters on a black background securely affixed to the equipment. The label shall indicate equipment served by the starter (equipment tag used on the Drawings). Labels shall be furnished and installed by the Contractor.

M. All starters for 3-phase equipment shall have overload devices in each phase.

N. Wiring diagrams shall be furnished by the Contractor.

O. Acceptable manufacturers shall be General Electric, Square D, Eaton, Siemens and Allen Bradley.

2.3 AIR FILTERS

A. All filters shall be U.L. 900 classified.

B. Filters shall be pleated disposable type (MERV 6 minimum) unless specified otherwise.
C. Install one set of new filters in air handling equipment during construction and install a new set prior to test and balance. Fan powered induction units shall have a temporary roll filter media installed at the plenum air inlet during construction. Remove temporary filter media prior to test and balance. Clean and vacuum all inlets prior to test and balance.

D. Temporary roll filter media shall be provided at the inlets to all air handling equipment operated during construction. Remove temporary filter media prior to test and balance. Clean and vacuum all inlets prior to test and balance.

PART 3 - EXECUTION

3.1 GENERAL

A. All equipment and materials shall be completely installed, adjusted, and fully operational with all accessories and connections.

B. Equipment, piping, ductwork, etc. shall fit into the spaces provided in the building and shall be installed at such time and in such a manner as to avoid damage and as required by the job progress. The Contractor shall coordinate work with other trades and locate work described herein to avoid interferences with structural, electrical and architectural work. Equipment, accessories and similar items requiring normal servicing or maintenance shall be accessible.

C. The Engineer reserves the right to direct the removal of any item which, in his opinion, does not present an orderly and reasonably neat or workmanlike appearance. Such removal and replacement shall be done when directed by the Engineer and without additional cost to the Owner.

D. Listed mounting heights are to the finished bottom of the device unless otherwise noted.

E. All work shall be designed and installed to comply with the requirements for the seismic design category and use group for the area in which the building is constructed.

3.2 STORAGE AND PROTECTION OF MATERIALS

A. During construction, all equipment shall be properly protected against damage, defacing and freezing with shipping cartons, plastic sheeting, shipping covers, etc.

B. All open ends of piping and equipment shall be sealed with nipples and caps, plugs, and test plugs until final connection to system is made.

C. All equipment, piping and ductwork shall be protected to prevent entrance of foreign matter and debris by covering exposed openings during construction.

D. Handle and store materials in accordance with manufacturer’s and supplier’s recommendations and in a manner to prevent damage to materials during storage and handling. Replace damaged materials.

E. Equipment and materials shall not be installed until such time as the environmental conditions of the job site are suitable to protect the equipment or materials. Equipment or materials damaged or which are subjected to these elements are unacceptable and shall be removed from the premises and replaced.
3.3 CUTTING AND PATCHING

A. The work shall include all cutting and patching required as part of the HVAC installation. Refer to Division 1 - General Requirements.

3.4 CONCRETE WORK

A. Construct curbs, pads and similar supports for equipment where required.
B. Provide 4\" thick housekeeping pads for all floor mounted equipment, extending 6\" beyond the area occupied by the equipment. Dowel pads to structural slab.
C. Perform concrete work in accordance with applicable portions of Division 3 - Concrete. Minimum compressive strength of concrete shall be same as specified for slabs on grade.
D. Mix and install grout for HVAC equipment base bearing surfaces and anchors. Provide forms as necessary and place grout to completely fill equipment bases.

3.5 EQUIPMENT SUPPORTS

A. Major equipment supports (structural steel frames, framed structural slab and wall openings, etc.) shall be furnished and installed by others; however, the HVAC work shall include furnishing and installation of all miscellaneous equipment supports, structural members, rods, clamps and hangers required to provide adequate support of all HVAC equipment.
B. Unless otherwise shown on the Drawings, all HVAC equipment, piping, and accessories shall be installed level, square, and plumb.
C. All equipment, piping, etc. supported by structural bar joists shall be supported only by the top chord of the joists. Hangers shall not be attached to the bottom chord of any joists.

3.6 PIPE AND DUCTWORK PENETRATIONS

A. Sleeves shall be installed in all masonry or concrete walls, floors, roofs, etc. for pipe and ductwork penetrations. Sleeves for pipe shall be schedule 40 black steel. Sleeves for ductwork shall be 20-gauge galvanized steel. Sleeves shall be sized to provide a minimum of 1/4" clearance between the sleeve and pipe or duct. For insulated pipes or ducts, the clearance shall be between the sleeve and the insulation.
B. As far as possible, all pipe and ductwork penetrations shall be provided for at the time of masonry or concrete construction. Where drilling is required, only core drills shall be used. Star drills shall not be used.
C. All pipes penetrating walls or floors of any construction shall be installed with escutcheon plates on both sides of the penetration securely fastened to the wall or floor. In exposed areas, escutcheon plates shall be chrome plated. All escutcheon plates shall be sized to completely conceal the penetration.
D. Ductwork penetrating walls or floors of any material shall be installed with closure plates on both sides of the penetration. Pipe penetrations through exterior walls shall be sealed.
weather-tight with expandable link type seals by Thunderline, Linkseal, or Engineer approved equal.

E. All pipe and duct penetrations of fire, smoke, or fire and smoke-rated assemblies shall be fire-stopped as required to retain the integrity of the UL-rated assembly. Fire barrier products shall be as manufactured by Tremco, Hilti, 3M, Metacaulk, Nelson, or approved equal. Refer to Division 7 - Thermal and Moisture Protection.

3.7 FLASHING
A. All piping and ductwork penetrating roofs shall be flashed in an approved manner, shall be watertight, and shall conform to the requirements detailed in Division 7 - Thermal and Moisture Protection.

3.8 EQUIPMENT LABELING
A. All HVAC equipment shall be labeled. This shall include all central plant, air handling or air conditioning equipment, air terminals, and other similar and miscellaneous equipment.
B. Labels for air terminals or other devices shall be located for optimum visibility through access panel or removed ceiling tiles.
C. Equipment labeling shall be one of the following, unless noted or specified otherwise:
   1. Permanently attached plastic laminated signs with 1” high lettering
   2. Stencil painted identification, 2” high letters, with standard fiberboard stencils and standard black (or other appropriate color) exterior stencil enamel

3.9 VALVE TAGS
A. Each valve in the HVAC system is to be provided with an individually numbered valve tag.
B. Valve tags are to be brass or plastic laminate, 1½” minimum diameter with brass chain and hook for securing to the valve.
C. Valve tags will include a designation to indicate the appropriate system. Numbering shall be consecutive for each service of the hot, chilled, steam, condensate return, or condenser water systems.
D. A printed list or schematic drawing shall be compiled for each system indicating the location and detailed description of the system or equipment served.
E. One (1) copy of each list shall be framed and mounted at the location designated by the Building Engineer. An additional copy of each list is to be included in the Operations and Maintenance Manual.

3.10 CLEANING
A. At all times, the premises shall be kept reasonably clean and free of undue amounts of waste, trash and debris by periodic cleaning and removal. After completion, all foreign material, trash and other debris shall be removed from the job site.
B. After all equipment has been installed, but prior to testing and balancing, all equipment, piping, ductwork, etc. shall be thoroughly cleaned both inside and out.

C. All water piping shall be chemically flushed and cleaned prior to circulating water through equipment.

D. After cleaning, filters shall be installed where required and all systems shall be tested and balanced.

E. After testing and balancing and just prior to Owner review and acceptance, all systems shall be finally cleaned and left ready for use.

3.11 PAINTING

A. Painting will be done under Division 9 - Painting except as otherwise noted, but the HVAC Contractor shall leave all surfaces of work free of rust, dirt and grease.

B. The HVAC Contractor shall touch-up any equipment scratched in shipment or during installation to match original finish. Touch-up painting of HVAC equipment shall be part of the HVAC work.

C. Any visible ductwork through grilles, registers and diffusers shall be painted flat black.

D. Provide one coat of rust preventive primer on all new structural steel supports and new ferrous surfaces not galvanized, including HVAC piping. Rust preventive painting shall be part of the HVAC work. Rust preventive paint shall be “Rust Destroyer” by Advanced Protective Products, Inc., Fairlawn, NJ, (201) 794-2000. Product shall have a 5-year warranty when applied directly over rust. Clean and prepare surface per manufacturer’s recommendations.

E. All painting and coating shall match the original finish and shall conform to the requirements detailed in Division 9 - Finishes.

F. Do not paint over equipment nameplates, nonferrous hardware, accessories or trim.

3.12 PRESSURE TESTING

A. Unless otherwise specified herein, all HVAC piping shall be tested as required by Code to 1-1/2 times the rated system pressure or 100 psig, whichever is greater. Care shall be taken to isolate all equipment not suitable for this test pressure by installing pipe caps or blank flanges at the equipment connections. All valves and fittings shall be tested under pressure.

3.13 PERFORMANCE AND DEMONSTRATION TESTS

A. All testing and demonstration of any and all HVAC systems required for acceptance by any authorities having jurisdiction shall be included as part of the HVAC work. This shall include the furnishing of any and all testing equipment, smoke generation devices, and any other required equipment or accessories, and all necessary labor required to perform any required tests or demonstrations. The Contractor shall coordinate and verify all devices, equipment and sequence of testing and/or events with such authorities having jurisdiction. The Contractor shall perform a minimum of two (2) satisfactory preliminary tests or demonstrations prior to any formal tests and/or demonstrations for any code.
authorities, and shall give a minimum of five (5) days advance notice to the Engineer of any and all preliminary tests and/or demonstrations, indicating the date and time of such tests.

3.14 TRAINING

A. Upon completion of the work, the Contractor shall conduct operation and training session(s) for the Owner’s key operating personnel. These sessions shall be of sufficient length and duration to adequately explain the design intent and proper operating and maintenance techniques for all HVAC equipment and systems. After these sessions are completed, the Contractor shall provide a copy of a signed statement by the Owner that his personnel are thoroughly familiar with and capable of operating all HVAC equipment and systems.

END OF SECTION
PART 1 - GENERAL

1.1 DESCRIPTION

A. All work in this section shall be subject to the provisions of Section 15000 - HVAC General.

B. Furnish and install all material, labor, accessories, etc. shown on the drawings and as specified herein to completely install all ductwork systems.

C. Ductwork systems shall be classified as follows:
   1. Static pressure class +2 in. wg - from constant volume air handling unit, and terminal unit to supply diffusers, and all return and exhaust ductwork
   2. Static pressure class +4 in. wg - from VAV air handling unit to PIU/VAV

D. Ductwork shall be constructed according to the latest edition of SMACNA ductwork construction standards applicable to the system pressures described above, and the system material construction.

E. Duct sizes shown on the drawings are nominal inside clear.

1.2 SUBMITTALS

A. For all fire dampers, combination fire and smoke dampers, and smoke dampers, submit UL approved installation instructions for each specific application.

PART 2 - PRODUCTS

2.1 DUCTWORK

A. All ductwork shall be constructed of galvanized steel sheets of the thickness listed in the SMACNA manuals for the pressures referenced above, or of 1” thick (1½” thick if required by the applicable energy code) resin bonded fiberglass with fire resistant foil-scrim-kraft vapor barrier.

B. Rectangular sheet metal duct elbows shall be smooth radius type without turning vanes or square (or mitered) type with turning vanes. Sharp throat elbows (ASHRAE Fitting No. CR3-2) shall not be permitted. Round sheet metal duct elbows shall be smooth radius type without turning vanes, gored type or mitered type with turning vanes.

C. Unless otherwise indicated, elbows shall have a centerline radius of not less than 1½ times the width of the duct. Where space limitations necessitate use of short radius or square elbows, provide turning vanes.

D. Fiberglass ductwork shall be UL-181 listed class 1 duct material with a minimum thermal conductivity of 0.23 at 75 degrees F.

E. Fiberglass ductboard shall be Johns-Manville “Superduct” Type 475, Knauf air duct Type E1-475 or Certainteed “Toughgard.”
F. Ductwork connecting kitchen exhaust hoods to rooftop exhaust fans shall be constructed of 16-gauge black steel with welded seams. All grease exhaust ductwork shall be constructed and installed according to requirements of local code authorities and NFPA 96 (latest edition) requirements. Slope duct down towards hood at 1” per linear foot or per local code requirements. Install gasketed access doors at each change of direction.

G. Kitchen hood exhaust ductwork shall be insulated per NFPA 96 (latest edition) and local code requirements. Kitchen hood supply ductwork shall be insulated per specifications for HVAC supply ductwork.

### 2.2 CONTROL DAMPERS

A. Automatic control dampers shall be installed as shown on the drawings and shall be controlled as described in the 15150 - Automatic Controls section of these specifications.

B. Unless indicated otherwise, dampers shall be of the opposed blade type constructed of minimum 18-gauge galvanized steel and shall have rigidly constructed blades less than 6” wide and shall have duct mounting flanges.

C. Dampers shall be the low leakage type with replaceable blade and jamb seals. Maximum pressure drop for dampers operating in systems exceeding 2000 fpm shall be 0.10” wg.

D. Outside air supply and exhaust openings shall be provided with a Class 1A motorized damper with a maximum leakage rate of 4 cfm/ft² (20.3 L/s · m²) at 1.0 in. wg (249 Pa) when tested in accordance with AMCA 500D.

1. Gravity (non-motorized) dampers having a maximum leakage rate of 20 cfm/ft² (101.6 L/s · m²) at 1.0 in. wg (249 Pa) when tested in accordance with AMCA 500D may be used in any one of the following conditions:

   a. In buildings for exhaust and relief dampers.
   b. In buildings of less than three stories in height above grade.
   c. For ventilation air intakes and exhaust and relief dampers in buildings of any height in Climate Zones 1, 2 and 3.
   d. Where the design outdoor air intake or exhaust capacity does not exceed 300 cfm (141 L/s).

   Gravity (non-motorized) dampers for ventilation air intakes shall be protected from direct exposure to wind.

2. Dampers smaller than 24 inches (610 mm) in either dimension shall be permitted to have a leakage rate of 40 cfm/ft² (203.2 L/s · m²) at 1.0 in. wg (249 Pa) when tested in accordance with AMCA 500D.

### 2.3 FLEXIBLE DUCT CONNECTORS

A. Install flexible duct connectors at connections of sheet metal duct to motor driven equipment, or otherwise noted. Flexible duct connectors shall be glass fabric coated with neoprene, suitable for the intended service. Flexible duct connectors shall be Duro Dyne Excelon or approved equal. Install per manufacturer’s instructions, and support sheet metal ductwork so that no weight is supported by the flexible duct connector.

B. Flexible connectors exposed to the weather shall be UV and ozone resistant.
C. Fabrics, coating and adhesives shall be tested in accordance with UL 701 and have a maximum flame spread/smoke developed rating of 25/50.

D. Flex duct connectors shall also be provided at building expansion joints.

2.4 ACCESS DOORS

A. Hinged, gasketed and latched access doors and/or panels shall be installed at each fire and smoke damper, each duct mounted smoke detector, each valve, at each duct mounted balancing damper or any other mechanical equipment or device that requires accessibility. Doors and panels shall be sized (minimum 18" x 18", duct size allowing), and located to optimize access to dampers, detectors, and other equipment for service and replacement. Access doors in ductwork shall be per SMACNA Standards. Access panels in walls, ceilings or other surfaces shall be coordinated with architectural finishes and selected by the architect.

B. Access doors shall be designed for five times the pressure of the duct in which it is mounted.

C. Access doors for grease exhaust ducts shall be in accordance with NFPA 96 (latest edition). Vertical grease ducts shall have an access door at each floor level in an inconspicuous location.

2.5 FLEXIBLE DUCTWORK

A. Flexible ductwork shall be UL Class I air duct.

B. Flexible ductwork (maximum 8'-0" long except in residential applications, length shall be as indicated) shall be installed between main supply ducts and diffusers.

C. Take-offs shall be made using spin-in type fittings with scoop and balancing damper. Flexible ductwork shall be Thermaflex M-KE R-6 (R value = 6.0 minimum or as required by local energy code) flexible air duct or approved equal. Duct size shall be the same size as diffuser neck it serves.

D. Flexible duct connections to ceiling diffusers shall be installed without kinks or sags to provide unrestricted airflow. Provide Flex Flow Elbow supports by Thermaflex.

2.6 DUCT INSULATION

A. Also refer to Section 15170 - HVAC Insulation.

B. Supply air ductwork a minimum of 15 linear feet (or as indicated) downstream of low pressure air handling equipment and terminal units shall be internally lined with 1½" thick acoustical duct liner/insulation (minimum R-6 or greater where required by code) Johns Manville Linacoustic RC or approved equal.

1. Duct liner shall be securely fastened to ductwork with stick pins, speed washers and adhesive. Leading edges of liner in medium pressure ductwork shall have a sheetmetal nosing.

2. Exposed edges and butt joints shall be “buttered” with duct sealer.
C. Supply air ductwork a minimum of 50 linear feet (or as indicated) downstream of static pressure class +4 in. wg air handling equipment shall be internally lined with 1½" thick acoustical duct liner/insulation, (minimum R-6 or greater where required by code) Johns Manville Linacoustic RC or approved equal.

D. Return air ductwork, sound boots and transfer ducts shall have 1" thick liner, Johns Manville Linacoustic RC or approved equal.
   1. Refer to Section 15170 - HVAC Insulation for return air ductwork requiring external insulation.

E. Round duct liner shall be 1" thick fiberglass duct liner/insulation (minimum R-4 or greater where required by code) Johns Manville Spiracoustic Plus or approved equal.

PART 3 - EXECUTION

3.1 DUCTWORK

A. All ductwork shall be installed in accordance with applicable SMACNA Standards according to the pressure class described in PART 1 - GENERAL.

B. Ductwork shall be supported as recommended by SMACNA Standards from structural members. Ductwork shall not be allowed to rest on ceilings, light fixtures or structural members. Ductwork supported from joists shall be supported from the top chord of all joists.

C. All ductwork accessories shall be installed in strict accordance with manufacturer’s recommendations.

D. Ductwork that is designed to operate at static pressures in excess of 3 in. wg and all ductwork located outdoors shall be leak-tested in accordance with SMACNA Standards. Representative sections totaling no less than 25% of the total installed duct area for the designated pressure class shall be tested. All sections shall be selected by the building owner or the designated representative of the building owner. Positive pressure leakage testing is acceptable for negative pressure ductwork. The maximum permitted duct leakage shall be:

\[
L_{\text{max}} = C_L P^{0.65}
\]

where
- \(L_{\text{max}}\) = maximum permitted leakage, cfm/100 ft² duct surface area
- \(C_L\) = 6, duct leakage class, cfm/100 ft² duct surface area at 1 in. wg
- \(P\) = test pressure, which shall be equal to the design duct pressure class rating, in. wg

All ductwork seams shall be sealed with mastic to provide a system that is within the recommended SMACNA leakage limits. Six (6) copies of the ductwork test report shall be submitted to the Engineer prior to the Contractor’s request for final payment.

E. All ductwork shall be cleaned inside and out prior to system start up, and shall be left in a neat and orderly manner.

F. Duct sizes shown on drawings are inside clear dimensions.
G. Unless otherwise approved, ducts shall be true to dimensions indicated, straight and smooth on the inside with neatly finished joints, securely anchored to the building in an approved manner, and installed to be completely free from vibration under all conditions of operation. Exact routing of ductwork will be dependent on location of framing members. Route ductwork to avoid cutting framing members.

H. Brace ducts not more than 60 inches on center.

I. Make slip joints in the direction of air flow.

J. Offset ducts around obstructions where possible. Where duct must encompass obstruction, area of duct shall remain constant.

K. Duct tapers shall not exceed 1:4 ratio and transformations 30 degrees between air flow and diverging or converging air flow.

L. Provide access doors for access to all equipment, dampers and motors concealed by sheet metal.

M. Where applicable, provide seismic bracing and restraints for ductwork per ASCE 7-10 and the latest edition of the SMACNA Seismic Restraint Manual. Also refer to Section 15051 Noise and Vibration Control.

3.2 BALANCING DAMPERS

A. Install manual volume dampers where indicated on the drawings and where required to properly balance the air distribution system.

B. Provide an opposed blade damper behind the face of each supply register which shall be adjustable through the face of the register with a screwdriver.

C. Provide a butterfly damper in the neck of each supply diffuser unless noted otherwise.

END OF SECTION
PART 1 - GENERAL

1.1 DESCRIPTION

A. Furnish and install all louver s, grilles, registers and diffusers of the size, type, capacity, and characteristics as shown on the equipment schedules and described herein.

B. Equipment schedules and specifications are based on the one manufacturer listed in the schedule. Other manufacturers of equal quality and performance may be submitted to the Engineer for review. When substitution of equipment is made, the Contractor shall be responsible for the costs of any item and engineering and construction revisions necessary in his or any other contract or trade that may be required to satisfy plans and specifications.

PART 2 - PRODUCTS

2.1 LOUVERS

A. Louver components (heads, jambs, sills, blades, etc.) shall be factory assembled by the manufacturer into a complete unit. Louver sizes too large for shipping shall be built-up by the Contractor from factory assembled louver sections to provide the overall sizes required.

B. Louver design shall incorporate structural supports required to withstand a wind load of 20 lbs. per square foot.

C. All louver performance data submitted for approval shall bear the AMCA Certified Ratings Seal for Air Performance and Water Penetration.

D. All louvers shall have a standard factory applied finish coating with color selection made by the Architect at the time of shop drawing approval. Color charts shall be submitted with louver shop drawings.

2.2 GRILLES, REGISTERS AND DIFFUSERS

A. Units shall be of the type, size, and construction as scheduled on the Drawings.

B. Unless otherwise noted on the Drawings, all units shall be supplied with a factory finish of white baked enamel.

C. Grilles, registers and diffusers shall be ordered with borders compatible with the ceiling system type in which they are installed.

D. Aluminum devices shall be used for all areas subject to excessive moisture or humidity (e.g. showers, pools, bathrooms, etc.).
PART 3 - EXECUTION

3.1 LOUVERS

A. Louvers shall be installed according to manufacturer’s recommendations, and shall be caulked and sealed at the frame and flanges to make the installation weatherproof.

B. Combination louver dampers shall be installed with required damper operators and linkage mechanisms and shall be field adjusted for full opening/closure stroke. Louvers shall be interlocked as indicated on the Drawings.

3.2 GRILLES, REGISTERS AND DIFFUSERS

A. All units located in ceiling tiles shall be centered or shall be on quarter points of 2 ft. x 2 ft. tiles.

B. Where a line of sight allows the ductwork, wall or ceiling structure to be seen behind any units, such ductwork, wall or ceiling structure shall be painted with nonflammable flat black paint to minimize visibility.

C. All units not installed on T-bar ceiling grids shall be securely fastened to adjacent structures.

D. Where air distribution devices are installed in inaccessible ceilings, provide spin-in with scoop without volume damper. Provide opposed blade damper in neck of air distribution device with access to damper control through face.

END OF SECTION
PART 1 - GENERAL

1.1 GENERAL REQUIREMENTS

A. General Conditions: Refer to the General Conditions, the Supplementary General Conditions and the Special Conditions, all provisions of which apply to work under this section as if written in full herein.

B. The scope of work described in these specifications and/or indicated on the drawings shall include (except where otherwise noted) the furnishing of all materials, equipment, appurtenances, accessories, connections, labor, etc. required and/or necessary to completely install, clean, inspect, adjust, test, balance and leave in safe and proper operating condition all mechanical systems. All mechanical work shall be accomplished by workmen skilled in the various trades involved.

C. The Contractor shall furnish and install underfloor disappearing type carbon monoxide exhaust system. The manufacturer shall be solely engaged in the manufacturing of carbon monoxide systems for a period of not less than ten (10) years.


PART 2 - PRODUCTS

2.1 FLOOR OUTLETS

A. Each floor outlet shall consist of a heavy cast aluminum frame with hinged lid, transition piece of heavy gauge galvanized steel (coated with rust preventive bituminous paint), and a cast aluminum hose seal centering device at base end of transition. Lids shall be hinged to casting with stainless steel pins and shall have heavy duty reinforcement bars underneath. Entire casting shall have beveled edges.

B. Floor casting shall fit directly into a 45 degree or 60 degree spur or upright “Y” fitting.

2.2 FLEXIBLE EXHAUST HOSE

A. Each floor outlet shall be complete with a crushproof neoprene hose assembly 6’ long x 4” diameter. One end of the hose assembly shall have a 20-gauge galvanized tailpipe adapter complete with gas analyzer slot and chain and hook assembly. The other end shall have a wire cage hose guide to help guide the hose back into the underfloor duct.

2.3 UNDERFLOOR EXHAUST DUCT

A. Pipe shall be 28-gauge (minimum) galvanized spiral lock-seam duct with integral stiffening rib, United McGill “Uni-Rib.” Duct shall be manufactured in accordance with SMACNA Standards.

B. Completely encase duct with 2” (minimum) concrete poured after pipe is laid in trench, joints are sealed airtight with duct sealer and duct has been leak tested.

C. Ensure interior joints are smooth and free of obstructions.
2.4 BLOWER ASSEMBLY

A. The blower unit shall be belt driven type with backward inclined wheel statically and dynamically balanced to deliver capacity indicated. Performance ratings shall be AMCA certified.

2.5 EXHAUST STACK

A. Furnish and install a stack set, 24-gauge galvanized duct from floor level up to blower inlet (including flexible connection), wall mounted type mounting bracket and exhaust duct from blower outlet (including flexible connection) through the roof terminating with gooseneck, flashing and counterflashing.

PART 3 - EXECUTION

3.1 INSTALLATION

A. System installation shall be in strict conformance with the Contract Documents and manufacturer’s recommendations.

3.2 LEAK TEST

A. Prior to encasing underfloor duct, perform leak test to ensure duct system is airtight. Leakage shall not exceed 2% of total airflow at 1-1/2 times system operating pressure.

END OF SECTION
PART 1 - GENERAL

1.1 DESCRIPTION

A. Furnish and install vibration control devices, materials, and related items. Perform all work as shown on the Drawings and as specified herein to provide complete vibration isolation systems in proper working order.

1.2 MATERIAL AND EQUIPMENT

A. Vibration isolation mounts shall be supplied by one of the following approved manufacturers:

1. Amber/Booth Co. (Houston, TX) A.B.
2. Mason Industries, Inc. (Hauppauge, NY) M.I.
3. Kinetics Noise Control, Inc. (Dublin, OH) K.N.C.
4. Vibration Eliminator Co., Inc. (Copiague, NY) V.E.
5. Vibration Mountings & Controls, Inc. (Butler, NJ) V.M.&C

B. Unless otherwise specified, supply only new equipment, parts and materials.

C. Substitutions of equal equipment beyond the alternatives listed will be permitted only with the written permission of the Architect. Accompany each request for acceptance of substitute equipment with manufacturer’s certified data proving the equivalence of the proposed substitute in quality and performance. The Architect shall be the final judge of the validity of the data submitted.

D. Unless otherwise approved by the Architect, field-installed vibration isolation equipment shall be furnished by a single manufacturer or his authorized representative, who shall also be responsible for all work specified in this section to be performed by the manufacturer.

1.3 REQUESTS FOR CHANGE

A. Any requests for changes to the specifications must be submitted in writing at least ten (10) days prior to bid closing. Approval will be given through a written addendum.

1.4 QUALITY ASSURANCE

A. Coordinate the size, location, and special requirements of vibration isolation equipment and systems with other trades. Coordinate plan dimensions with size of housekeeping pads.

B. Provide vibration isolators of the appropriate sizes, with the proper loading to meet the specified deflection requirements.

C. Supply and install any incidental materials such as mounting brackets, attachments and other accessories as may be needed to meet the requirements stated herein, even if not expressly specified or shown on the Drawings, without claim for additional payment.

D. Verify correctness of equipment model numbers and conformance of each component with manufacturer’s specifications.
E. Should any rotating equipment cause excessive noise or vibration when properly installed on the specified isolators, the Contractor shall be responsible for rebalancing, realignment, or other remedial work required reducing noise and vibration levels. Excessive is defined as exceeding the manufacturer’s specifications for the unit in question.

F. Upon completion of the work, the Architect or Architect’s representative shall inspect the installation and shall inform the installing contractor of any further work that must be completed. Make all adjustments as directed by the Architect that result from the final inspection. This work shall be done before vibration isolation systems are accepted.

1.5 SUBMITTALS

A. Refer to related sections elsewhere for procedural instructions for submittals.

B. Before ordering any products, submit shop drawings of the items listed below. The shop drawings must be complete when submitted and must be presented in a clear, easily understood form. Incomplete or unclear presentation of shop drawings may be reason for rejection.

1. A complete description of products to be supplied, including product data, dimensions, specifications, and installation instructions.

2. Detailed selection data for each vibration isolator supporting equipment, including:
   a. The equipment identification mark;
   b. The isolator type;
   c. The actual load;
   d. The static deflection expected under the actual load;
   e. The specified minimum static deflection.

3. Steel rails, steel base frames, and concrete inertia bases showing all steel work, reinforcing, vibration isolator mounting attachment method, and location of equipment attachment bolts.

4. Special details necessary to convey complete understanding of the work to be performed.

C. Submission of samples may be requested for each type of vibration isolation device. After approval, samples will be returned for installation at the job if requested. All costs associated with submission of samples shall be borne by the Contractor.

1.6 DESIGN REQUIREMENTS

A. Design isolators for equipment installed outdoors to provide adequate restraint to withstand the force as required by code to any exposed surface of the isolated equipment. Isolators for outdoor equipment shall have bolt holes for attachment to equipment and to supports. The vibration isolation Vendor shall submit verifying shear and over turning calculations, for their product and equipment installation arrangement, stamped by a licensed Professional Engineer. The design and supply of miscellaneous support steel above and below isolators will not be the responsibility of the vibration isolation manufacturer.
1.7 VIBRATION ISOLATION AND SEISMIC RESTRAINT

A. Scope

1. Provide isolators, flexible connections, and equipment bases for all rotating, piston driven, or vibrating equipment.
2. Guarantee specified isolation system deflections.
3. Provide installation instructions, drawings, and field supervision to ensure proper installation and performance of all items specified in this section.
4. Design, furnish, and install attachment devices, anchor bolts, and seismic restraints that are required for seismic compliance for all equipment, apparatus piping, conduit and raceways, ductwork, and other components of the specified systems required by codes and standards. “Attachment Devices” are devices such as double sided beam clamps, concrete inserts, and attachment plates that serve to secure the supported device into the structure.
5. Provide seismic restraint types as described. If the item to be restrained is not listed, select appropriate restraint and submit for approval.
6. In addition, seismic bracing for Fire Protection systems shall conform to NFPA 13.

B. Definitions

1. “Attachment Devices” are devices such as double sided beam clamps, concrete inserts, and attachment plates that serve to secure the supported device to the structure.
2. “Positive Attachment” is defined as a support location with a cast-in or wedge type expansion anchor, a double-sided beam clamp, or a welded or through bolted connection to the structure.
3. “Transverse Bracing” Restraint(s) applied to limit motion perpendicular or angular to the centerline of the pipe, duct, or conduit.
4. “Longitudinal Bracing” Restraint(s) applied to limit motion perpendicular or angular to the centerline of the pipe, duct, conduit, etc.
5. Life Safety Systems

   a. All systems involved with fire protection, including sprinkler piping, fire pumps jockey pumps, fire pump control panels, service water supply piping, water tanks, and fire dampers.
   b. All systems involved with and/or connected to emergency power supply, including all generators, transfer switches, transformers and all circuits to fire equipment.
   c. All systems involved with and/or connected to emergency power supply, including all generators, transfer switches, transformers and all circuits to fire protection, smoke evacuation and/or emergency lighting systems.

C. Reference Codes and Standards

1. 2012 Standard Building Code
3. Seismic design category
D. Exclusions from Seismic Restraint Requirements

1. With the exception of life safety components, certain components do not require seismic restraints. These are specified herein.

E. Submittal Data Requirements

1. Submittals
   a. Catalog cuts or data sheets on specific products utilized, which detail compliance with the specification. Reference “TYPE” as per “PRODUCTS” section of this specification.

2. Shop Drawings
   a. Show base construction for equipment; include dimensions, weights, structural member sizes and support point locations.
   b. Indicate isolation devices selected with complete dimensional and deflection data before condition is accepted for installation.
   c. Calculate thrust for fan heads (axial and centrifugal fans) to determine whether thrust restraints are required.

F. Seismic Certification and Analysis

1. Seismic restraint calculations shall be provided for all connections of equipment to the structure. All performance of products (such as: strut, cable, anchors, clips, etc.) associated with restraints shall be supported with manufacturer’s data sheets or certified calculations.

2. Seismic restraint calculations shall be based on the acceleration criteria required by local codes. Note: For roof-mounted equipment, both the seismic acceleration and wind loads shall be calculated, the highest load shall be utilized for the design of the restraints and isolators.

3. Calculations to support seismic restraint design shall be stamped by a registered professional engineer with at least five years of seismic design experience.

4. Table elevations refer to the structural point of attachment of the equipment support system (i.e., use floor slab for floor supported equipment and the elevation of the slab above for suspended equipment).

5. Analysis shall indicate calculated dead loads, derived loads and materials utilized for connections to equipment and structure. Analysis shall detail anchoring methods, bolt diameter, embedment and/or weld length.

6. Certification and analysis report shall be submitted along with other HVAC submittals.

G. Manufacturer Inspection

1. Upon completion of installation of all vibration isolation and seismic restraint devices, a certification report prepared by the manufacturer shall be submitted in writing to the Contractor indicating that all systems are installed properly and in compliance with the specifications. The report must identify those areas that require corrective measures or certify that none exist. Any field coordination type changes to the originally submitted seismic restraint designs must be clearly defined and detailed in this report.
2.1 VIBRATION ISOLATOR TYPES

A. General

2. Isolators installed out-of-doors shall have base plates with bolt holes for fastening the isolators to the support members.
3. Isolator types are scheduled to establish minimum standards. At the Contractor’s option, labor-saving accessories can be an integral part of isolators supplied to provide initial lift of equipment to operating height, hold piping at fixed elevations during installation and initial system filling operations, and similar installation advantages. Accessories and seismic restraint features must not degrade the isolation performance of the isolators.
4. Static deflection of isolators shall be as provided in the EXECUTION section and as shown on the Drawings. All static deflections stated are the minimum acceptable deflection for the mounts under actual load. Isolators selected solely on the basis of rated deflections are not acceptable and will be disapproved.

B. Type FSN (Floor Spring and Neoprene)

1. FSN isolators shall be freestanding and laterally stable without any housing. Spring diameter shall be not less than 0.8 of the compressed height of the spring at the rated load. Springs shall have a minimum additional travel-to-solid equal to 50% of the rated deflection. Springs shall be so designed that the ratio of horizontal stiffness to vertical stiffness is approximately 1. Mounts shall have leveling bolts.
2. The spring element in the isolator shall be set in a neoprene cup and have a steel washer or a flat surface in contact with the neoprene to distribute the load evenly over the bearing surface of the neoprene. Alternatively, each isolator shall be mounted on a Type NP isolator. If the NP isolator is used, a rectangular bearing plate of appropriate size shall be provided to load the pad uniformly within the manufacturer’s recommended range. If the isolator is to be fastened to the building and the NP isolator is used, the holes in the isolator base plate shall be oversized and GROMMETS shall be provided for each base plate bolt hole.
3. If the basic spring isolator has a neoprene friction pad on its base and an NP isolator is to be added to the base, a galvanized steel, stainless steel or aluminum bearing plate shall be used between the friction pad and the NP isolator. If the isolator is outdoors, bearing plates shall not be made of galvanized steel. The NP isolator, bearing plate and friction pad shall be permanently adhered to one another and to the bottom of the isolator base plate.
4. Type FSN isolators shall be one of the following products with the appropriate neoprene pad (if used) selected from Type NP or approved equal:
   a. Type SW A.B.
   b. Type SLF M.I.
   c. Type FDS K.N.C.
   d. Type OST V.E.
   e. Series AC V.M.&C.
C. Type FSNTL (Floor Spring and Neoprene Travel Limited)

1. FSNTL isolators shall be freestanding and laterally stable without any housing. Spring diameter shall be not less than 0.8 of the compressed height of the spring at the rated load. Spring shall have a minimum additional travel-to-solid equal to 50% of the rated deflection. Springs shall be so designed that the ratio of horizontal stiffness to vertical stiffness is approximately 1. Mounts shall have leveling bolts. Mounts shall have vertical travel limit stops to control extension when weight is removed. The travel limit stops shall be capable of serving as blocking during erection of the equipment. A minimum clearance of 1/4" shall be maintained around restraining bolts and between the limit stops and the spring to avoid interference with the spring action.

2. The spring element in the isolator shall be set in a neoprene cup and have a steel washer or a flat surface in contact with the neoprene to distribute the load evenly over the bearing surface of the neoprene. Alternatively, each isolator shall be mounted on a Type NP isolator. If the NP isolator is used, a rectangular bearing plate of appropriate size shall be provided to load the pad uniformly within the manufacturer's recommended range. If the isolator is to be fastened to the building and the NP isolator is used, the holes in the isolator base plate shall be oversized and GROMMETS shall be provided for each base plate bolt hole.

3. If the basic spring isolator has a neoprene friction pad on its base and an NP isolator is to be added to the base, a galvanized steel, stainless steel or aluminum bearing plate shall be used between the friction pad and the NP isolator. If the isolator is outdoors, bearing plates shall not be made of galvanized steel. The NP isolator, bearing plate and friction pad shall be permanently adhered to one another and to the bottom of the isolator base plate.

4. Type FSNTL isolators shall be one of the following products, with the appropriate neoprene pad (if used) selected from Type NP or approved equal:

   a. Type CT A.B.
   b. Type SLR M.I.
   c. Type FLS K.N.C.
   d. Type KW V.E.
   e. Series AWR V.M.&C.

D. Type FN (Floor Neoprene)

1. NP isolators shall be neoprene-in-shear type with steel reinforced top and base. All metal surfaces shall be covered with neoprene. The top and bottom surfaces shall be ribbed. Bolt holes shall be provided in the base and the top shall have a threaded fastener. The mounts shall include leveling bolts that may be rigidly connected to the equipment.

2. Type FN isolators shall be one of the following products or approved equal:

   a. Type RVD A.B.
   b. Type ND M.I.
   c. Type RD K.N.C.
   d. Type D44 V.E.
   e. Series RD V.M.&C.
E. Type FNC (Floor Neoprene Constrained)

1. FNC isolators shall incorporate bridge-bearing neoprene elements with all-directional restraint. The mount shall consist of a ductile iron casting containing two (2) separated and opposing molded neoprene elements. The elements shall prevent the central threaded sleeve and attachment bolt from contacting the casting during normal operation. Bolt holes shall be provided in the base and the top shall have a threaded fastener.

2. Type FNC isolators shall be one of the following products or approved equal:
   a. Type BR M.I.
   b. Series RSM V.M.&C.

F. Type PCF (Pre-compressed Fiberglass)

1. PCF isolator blocks shall be made of molded inorganic glass fiber that is individually coated and sealed with an impervious elastomeric membrane. Fiberglass shall be severely overloaded during the manufacturing process to stabilize the material into a product that is permanent and has consistent, predictable dynamic properties.

2. Type PCF isolators shall be one of the following products or approved equal:
   a. Type KIP K.N.C.

G. Type NP (Neoprene Pad)

1. NP isolators shall be one layer of 5/16" to 3/8" thick ribbed or waffled neoprene. The pads shall be sized so that they will be loaded within the manufacturer’s recommended range.

2. Type NP isolators shall be one of the following products or approved equal:
   a. Type NR A.B.
   b. Type W M.I.
   c. Type NPS K.N.C.
   d. Type 200N V.E.
   e. Series Maxi-Flex V.M.&C.

H. Type DNP (Double Neoprene Pad)

1. DNP isolators shall be formed by two layers of 1/4" to 3/8" thick ribbed or waffled neoprene, separated by a galvanized steel, stainless steel or aluminum plate. If the isolator is outdoors, the plate shall not be made of galvanized steel. These layers shall be permanently adhered together. The pads shall be sized so that they will be loaded within the manufacturer’s recommended range.

2. Type DNP isolators shall be formed from one of the following products or approved equal:
   a. Type NR A.B.
   b. Type WSW M.I.
   c. Type NPS K.N.C.
   d. Type 200N (Multilayers) V.E.
   e. Series Maxi-Flex V.M.&C.
I. Type HSN (Hanger Spring and Neoprene)

1. HSN isolators shall consist of a freestanding and laterally stable steel spring and a neoprene element in series, contained within a steel housing. Spring diameters and hanger housing lower hole sizes shall be large enough to permit the hanger rod to swing through a 30 degrees arc before contacting the housing. Alternatively, other provisions shall be made to allow for a 30 degrees arc of movement of the bottom hanger rod without contacting the isolator housing. Spring diameter shall be not less than 0.8 of the compressed height of the spring at the rated load. Spring elements shall have a minimum additional travel-to-solid equal to 50% of the rated deflection. The neoprene element shall be designed to have a 0.3" minimum static deflection. The deflection of both the spring element and the neoprene element shall be included in determining the overall deflection of Type HSN isolators.

2. A pre-compressed glass fiber element may be substituted for the neoprene element.

3. Type HSN isolators shall be one of the following products or approved equal:
   a. Type BSR-A A.B.
   b. Type 30N M.I.
   c. Type SRH or SFH K.N.C.
   d. Type SNRC V.E.
   e. Type RSH 30A or RSHSC V.M.&C.

J. Type HN (Hanger Neoprene)

1. HN isolators shall consist of a neoprene-in-shear element contained within a steel housing. A neoprene neck bushing shall be provided where the hanger rod passes through the hanger housing to prevent the rod from contacting the hanger housing.

2. A pre-compressed glass fiber element may be substituted for the neoprene element.

3. Type HN isolators shall be one of the following products or approved equal:
   a. Type BRD-A A.B.
   b. Type HD M.I.
   c. Type RH or FH K.N.C.
   d. Type 3C V.E.
   e. Type RHD V.M.&C.

2.2 EQUIPMENT BASES

A. Type BSR (Base - Steel Rail)

1. Steel rail bases shall consist of structural steel sections sized to provide a rigid beam that will not twist, deform, or deflect in any manner that will negatively affect the supported equipment or the vibration isolation mounts. Rail bases shall include mounting brackets for attachment of vibration isolators.

2. Type BSR bases shall be one of the following products or approved equal:
   a. Type C or CIS A.B.
   b. Type R or ICS M.I.
   c. Type KRB or KFB K.N.C.
d. Type CS V.E.
e. Type WFR V.M.&C.

B. Type BSF (Base - Steel Frame)

1. Steel frame bases shall consist of structural steel sections sized, spaced, and connected to form a rigid base which will not twist, rack, deform, or deflect in any manner which will negatively affect the supported equipment or the vibration isolation mounts. Frames shall be adequately sized to support basic equipment units and motors plus any associated pipe elbow supports, duct elbow supports, electrical control elements, or other components closely related and requiring resilient support in order to prevent vibration transfer to the building structure. The depth of steel frame bases shall be at least 1/10 the longest dimension of the base supported between isolators and not less than 6". The base footprint shall be large enough to provide stability for supported equipment.

2. Frame bases shall include side mounting brackets for attachment to vibration isolators. Mounting brackets shall be located on the sides of the base that are parallel to the axis of rotation of the supported equipment.

3. Type BSF bases shall be one of the following products or approved equal:
   a. Type WX A.B.
   b. Type WFSL M.I.
   c. Type SFB K.N.C.
   d. Type HB V.E.
   e. Series WFB V.M.&C.

C. Type BIB (Base - Inertia Base)

1. Inertia bases shall be formed of stone-aggregate concrete (150 lb/cu. ft.) and appropriate steel reinforcing cast between welded or bolted perimeter structural steel channels. Inertia bases shall be built to form a rigid base that will not twist, rack, deform, deflect, or crack in any manner that would negatively affect the supported equipment or the vibration isolation mounts. Inertia bases shall be adequately sized to support basic equipment units and motors plus any associated pipe elbow supports, duct elbow supports, electrical control elements, or other components closely related and requiring resilient support in order to prevent vibration transfer to the building structure. Inertia base depth shall be at least 1/12 the longest dimension of the base supported between isolators and not less than 6". The base footprint shall be large enough to provide stability for supported equipment. Inertia bases shall include side mounting brackets for attachment to vibration isolators. Mounting brackets shall be located on the sides of the base that are parallel to the axis of rotation of the supported equipment. Concrete may be provided by the General Contractor.

2. Frame and reinforcement for Type BIB bases shall be one of the following products or approved equal:
   a. Type CPF A.B.
   b. Type KSL or BMK M.I.
   c. Type CIB-L or CIB-H K.N.C.
   d. Type SN V.E.
   e. Series MPF or WPF V.M.&C.
D. Type RC-1 (Roof Curb, Type 1)

1. Type RC-1 isolation bases shall be a prefabricated assembly consisting of an extruded aluminum frame and steel spring isolation system that fits over the roof curb and under the isolated equipment. The aluminum frame shall be sufficiently rigid to support the equipment load without detrimental twist or deflection. Spring isolators shall be selected and positioned along the curb to achieve the minimum static deflection called for in the schedule. The static deflection shall be constant around the entire periphery of the base. Springs shall be free standing, laterally stable with a diameter of not less than 0.8 times the compressed height, and have additional travel-to-solid that is at least 50% of the rated deflection. Resilient neoprene snubbers shall be provided at the corners of the base to limit equipment movement to 1/4" under wind load.

2. The isolation curb base shall be made weather tight by sealing all around the periphery with closed cell neoprene or flexible membrane that shall in no way inhibit the vibration isolation of the spring elements. Closed cell sponge gasketing or field caulking shall be used between the equipment unit and the isolation curb base and between the isolation curb and roof curb to form a weather-tight seal. Each spring isolator used in the curbs shall be weather-protected as described in the PRODUCTS section under General.

3. Type RC-1 vibration isolation curb bases shall be supplied by the isolator manufacturer and shall be one of the following products or approved equal:

   a. Type RTIR A.B.
   b. Type CMAB M.I.
   c. Type ASR K.N.C.
   d. Type AR V.E.
   e. Series AXR V.M.&C.

E. Type RC-2 (Roof Curb, Type 2)

1. Type RC-2 isolation bases shall be a prefabricated assembly consisting of a structural steel frame and steel spring isolation system that also forms the roof curb under the isolated equipment. The steel frame shall be sufficiently rigid to support the equipment load without detrimental twist or deflection. Spring isolators shall be selected and positioned along the curb to achieve the minimum static deflection called for in the schedule. The static deflection shall be constant around the entire periphery of the base. Springs shall be free standing, laterally stable with a diameter of not less than 0.8 times the compressed height, and have additional travel-to-solid that is at least 50% of the rated deflection. Spring isolators shall include travel limit stops that are capable of serving as blocking during erection of the equipment. A minimum clearance of 1/4" shall be maintained around restraining bolts as they pass through the limit stop brackets. Springs and limits stops shall be provided at the corners of the base to limit equipment movement to 1/4" under wind load.

2. The isolation curb base shall be made weather tight by sealing all around the periphery with closed cell neoprene, flexible membrane or light gauge spring metal loop, which shall in no way inhibit the vibration isolation of the spring elements. A closed cell sponge gasket or field caulking shall be used between the equipment unit and the isolation curb base and between the isolation curb and roof curb to form a weather-tight seal. Each spring isolator used in the curbs shall be weather-protected as described in the PRODUCTS section under General.
3. Type RC-2 vibration isolation curb bases shall be supplied by the isolator manufacturer and shall be one of the following products or approved equal:

   a. Type RSC M.I.
   b. Type SSR K.N.C.
   c. Vibrocurb ThyCurb

2.3 RESILIENT PENETRATION SLEEVE/SEAL

A. Resilient penetration sleeve/seals shall be field-fabricated from a pipe or sheet metal section that is 1/2" to 3/4" larger than the penetrating element in all directions around the element, and shall be used to provide a sleeve through the construction penetrated. The sleeve shall extend 1" beyond the penetrated construction on each side. The space between the sleeve and the penetrating element shall be packed with glass fiber or mineral wool to within 1/4" of the ends of the sleeve. The remaining 1/4" space on each end shall be filled with acoustical sealant to form an airtight seal. The penetrating element shall be able to pass through the sleeve without contacting the sleeve. Alternatively, prefabricated sleeves accomplishing the same result are acceptable.

2.4 RESILIENT LATERAL SUPPORTS

A. These units shall either be a standard product of the vibration isolator manufacturer, or be custom fabricated from standard components. These units shall incorporate neoprene isolation elements similar to Type FN that are specifically designed to provide resilient lateral bracing of ducts or pipes.

B. Resilient lateral supports shall be one of the following products or approved equal:

   1. Type Custom A.B.
   2. Type ADA M.I.
   3. Type RGN K.N.C.
   4. Type VERG or VPL V.E.
   5. Type MDPA V.M.&C.

2.5 FLEXIBLE DUCT CONNECTIONS

A. Flexible duct connections shall be made from coated fabric. The clear space between connected parts shall be a minimum of 3", and the connection shall have a minimum of 1.5" of slack material.

2.6 FLEXIBLE PIPE CONNECTIONS

A. Flexible pipe connections shall be fabricated of multiple plys of nylon cord, fabric, and neoprene; and shall be vulcanized so as to become inseparable and homogeneous. Flexible connections shall be formed in a double sphere shape, and shall be able to accept compressive, elongating, transverse, and angular movements.

B. The flexible connections shall be selected and specially fitted, if necessary, to suit the system temperature, pressure, and fluid type. In addition, suitable flexible connections should be selected, if possible, which do not require rods or cables to control extension of the connector.
C. Connectors for pipe sizes 2” or smaller shall have threaded female union couplings on each end. Larger sizes shall be fitted with metallic flange couplings.

D. Flexible pipe connections shall be one of the following or an approved equal:

1. Type 2600 or 2655 A.B.
2. Type Twin Sphere Metraflex
3. Type MFTNC or MFTFU M.I.
4. Double Sphere Flexible Connectors V.E.
5. Series VMT or VMU V.M.&C.

2.7 THRUST RESTRAINTS

A. Thrust restraints shall consist of a spring element in series with a neoprene pad. The unit shall be designed to have the same deflection due to thrust-generated loads as specified for the isolators supporting the equipment. The spring element shall be contained within a steel frame and be designed so it can be pre-compressed at the factory to allow for a maximum of 1/4” movement during starting or stopping of the equipment. Allowable movement shall be field-adjustable. The assembly shall be furnished complete with rods and angle brackets for attachment to both the equipment and the adjacent fixed structural anchor. The thrust restraints shall be installed on the discharge of the fan so that the restraint rods are in tension. Assemblies that place the rods in compression are not acceptable. The holes in the spring restraint brackets through which the restraint rods pass must be oversized to prevent contact between the brackets and rods.

B. Thrust restraints shall be one of the following products or an approved equal:

1. Type TRK A.B.
2. Type HSR K.N.C.
3. Type WB M.I.
4. Thrust Restraint V.E.

2.8 GROMMETS

A. Grommets shall be made of neoprene or neoprene impregnated duct that is specially formed to prevent bolts from directly contacting the isolator base plate, and shall be sized so that they will be loaded within the manufacturer’s recommended load range.

B. Grommets shall either be custom made by combining a neoprene washer and sleeve, or be one of the following products or an approved equal:

1. Type Isogrommets MBIS, Inc. (Bedford Heights, OH)
2. Type WB Barry Controls (Brighton, MA)
3. Type HG Mason Industries Inc. (Hauppauge, NY)

2.9 ACOUSTICAL SEALANT

A. Sealants for acoustical purposes as described in this specification shall be silicone or one of the resilient, non-hardening sealants indicated below:

1. Acoustical sealant D.A.P.
2. BR-96 or AC-20 (AC-20 FTR - Fire Rated) Pecora
3. Sonoloc Sanborn
4. Acoustical Sealant #834 (Acrylic Latex) Tremco
5. Acoustical sealant U.S.G.

PART 3 - EXECUTION

3.1 APPLICATION

A. General

1. Refer to the PRODUCTS section of this specification for vibration isolation devices identified on the Drawings or specified herein.
2. The static deflection of all isolators specified herein is the minimum acceptable deflections for the mounts under actual load. Isolators selected solely on the basis of rated deflection are not acceptable and will be disapproved.

B. Major Equipment Isolation

1. Unless otherwise shown or specified, all floor-mounted major equipment shall be set on housekeeping pads. See architectural or structural drawings for details.
2. Types and minimum static deflections of vibration isolation devices for major equipment items shall be as scheduled on the Drawings or specified hereunder.
3. Flexible duct connections shall be installed at all fan unit intakes, fan unit discharges, and wherever else shown on the Drawings.
4. Flexible pipe connections shall be installed at all pipe connections to vibration-isolated equipment in the positions shown on the Drawings.
5. Electrical connections to vibration-isolated equipment shall be flexible, as called for in the electrical portion of the specification.
6. Thrust restraints shall be installed on all suspended fans and on all floor-mounted fans developing 4" or more of static pressure, unless the horizontal component of the thrust force can be demonstrated to be less than 10% of the equipment weight.

C. Miscellaneous HVAC Equipment Isolation

1. Miscellaneous pieces of HVAC equipment, such as converters, pressure reducing stations, dryers, strainers, storage tanks, condensate receiver tanks, and expansion tanks, which are connected to isolated piping systems, shall be vibration-isolated from the building structure by Type NP or Type HN isolators (selected for 0.1" static deflection), unless their position in the piping system requires a higher degree of isolation as called for under Pipe Isolation.

D. Pipe Isolation

1. All chilled water, condenser water, hot water, steam, refrigerant, drain and engine exhaust piping that is connected to vibration-isolated equipment shall be isolated from the building structure within the following limits:
   a. Within mechanical rooms;
   b. Within 50' total pipe length of connected vibration-isolated equipment (chillers, pumps, air handling units, pressure reducing stations, etc.);
   c. At every support point for piping that is greater than 4" in diameter.
2. Piping shall be isolated from the building structure by means of vibration isolators, resilient lateral supports, and resilient penetration sleeve/seals.

3. Isolators for the first three support points adjacent to connected equipment shall achieve one half the specified static deflection of the isolators supporting the connected equipment. When the required static deflection of these isolators is greater than 1/2", Type FSN or HSN isolators shall be used. When the required static deflection is less than or equal to 1/2", Type FN or HN isolators shall be used. All other pipe support isolators within the specified limits shall be either Type FN or HN achieving at least 1/4" static deflection.

4. Where lateral support of pipes is required within the specified limits, this shall be accomplished by use of resilient lateral supports.

5. Pipes within the specified limits that penetrate the building construction shall be isolated from the building structure by use of resilient penetration sleeve/seals.

6. Provide flexible pipe connections as called for under Major Equipment above and wherever shown on the Drawings.

E. Duct Isolation

1. All sheet metal ducts and air plenums that are within mechanical rooms or within a distance of 50' total duct length of connected vibration-isolated equipment (whichever is longer) shall be isolated from the building structure by Type FN, PCF or HN isolators. All isolators shall achieve 0.1" minimum static deflection.

2. Ducts within the specified limits that penetrate the building construction shall be isolated from the building structure by use of resilient penetration sleeve/seals.

3. Flexible duct connections shall be provided as called for above under Major Equipment and wherever shown on the Drawings.

3.2 INSTALLATION OF VIBRATION ISOLATION EQUIPMENT

A. General

1. Locations of all vibration isolation devices shall be selected for ease of inspection and adjustment as well as for proper operation.

2. Installation of vibration isolation equipment shall be in accordance with the manufacturer's instructions.

B. Isolators

1. All vibration isolators shall be aligned squarely above or below mounting points of the supported equipment.

2. Isolators for equipment with bases shall be located on the sides of the bases which are parallel to the equipment shaft unless this is not possible because of physical constraints.

3. Locate isolators to provide stable support for equipment, without excess rocking. Consideration shall be given to the location of the center of gravity of the system and the location and spacing of the isolators. If necessary, a base with suitable footprint shall be provided to maintain stability of supported equipment, whether or not such a base is specifically called for herein.

4. If a housekeeping pad is provided, the isolators shall bear on the housekeeping pad and the isolator base plates shall rest entirely on the pad.

5. Hanger rods for vibration-isolated support shall be connected to major structural members, not the floor slab between major structural members. Provide suitable intermediate support members as necessary.
6. Vibration isolation hanger elements shall be positioned as high as possible in the hanger rod assembly, but not in contact with the building structure, and so that the hanger housing may rotate a full 360 degrees about the rod axis without contacting any object.

7. Parallel running pipes may be hung together on a trapeze that is isolated from the building. Isolator deflections must be the greatest required by the provisions for pipe isolation for any single pipe on the trapeze. Do not mix isolated and un-isolated pipes on the same trapeze.

8. Pipes, ducts and equipment shall not be supported from other pipes, ducts and equipment.

9. Resiliently isolated pipes, ducts and equipment shall not come in rigid contact with the building construction or rigidly supported equipment.

10. The installed and operating heights of equipment supported by Type FSNTL isolators or with Type RC-2 isolation bases shall be identical. Limit stops shall be out of contact during normal operation. Adjust isolators to provide 1/4" clearance between the limit stop brackets and the isolator top plate, and between the travel limit nuts and travel limit brackets.

11. Adjust all leveling bolts and hanger rod bolts so that the isolated equipment is level and in proper alignment with connecting ducts or pipes.

C. Bases

1. No equipment unit shall bear directly on vibration isolators unless its own frame is suitably rigid to span between isolators and such direct support is approved by the equipment manufacturer. This provision shall apply whether or not a base frame is called for on the schedule. In the case that a base frame is required for the unit because of the equipment manufacturer’s requirements and is not specifically called for on the equipment schedule, a base frame recommended by the equipment manufacturer shall be provided at no additional expense.

2. Unless otherwise indicated, there is to be a minimum operating clearance of 1” between steel rails, steel frame bases or inertia bases and the floor beneath the equipment. The isolator mounting brackets shall be positioned and the isolators adjusted so that the required clearance is maintained. The clearance space shall be checked by the Contractor to ensure that no construction debris has been left to short circuit or restrict the proper operation of the vibration isolation system.

3. Isolation bases shall be installed in strict accordance with the manufacturer’s instructions.

D. Flexible Duct Connections

1. Prior to installation of the flexible connection, sheet metal ducts and plenum openings shall be squarely aligned with the fan discharge, fan intake, or adjacent duct section, and the gap between connected parts shall be uniform. Flexible duct connections shall not be installed until this provision is met. There shall be no metal-to-metal contact between connected sections, and the fabric shall not be stretched taut.

E. Flexible Pipe Connections

1. Install flexible pipe connections in strict accordance with the manufacturer’s instructions.
F. Thrust Restraints

1. Thrust restraints shall be attached on each side of the fan parallel to the thrust force. This may require custom brackets or standoffs. The body of the thrust restraint shall not come in contact with the connected elements. Thrust restraints shall be adjusted to constrain equipment movement to the specified limit.

G. Grommets

1. Where grommets are required at hold down bolts of isolators, bolt holes shall be properly sized to allow for grommets. The hold down bolt assembly shall include washers to distribute load evenly over the grommets. Bolts and washers shall be galvanized.

H. Resilient Penetration Sleeve/Seals

1. Maintain an airtight seal around the penetrating element and prevent rigid contact between the penetrating element and the building structure. Fit the sleeve tightly to the building construction and seal airtight on both sides of the construction penetrated with acoustical sealant.

END OF SECTION
PART 1 - GENERAL

1.1 DESCRIPTION

A. Furnish and install direct expansion air cooled split system units of the size and capacity shown on the equipment schedules.

B. Units shall be factory matched with air handling units for compatibility and shall be rated in accordance with ARI standards.

C. Equipment schedules and specifications are based on Carrier series units. Other manufacturers of equal quality and capacity may be submitted to the Engineer for approval. When substitution of equipment is made, the Contractor shall be responsible for the costs of any item and engineering and construction revisions necessary in his or any other contract that may be required to satisfy plans and specifications.

D. Equal products: Mitsubishi, Bryant, Daiken

PART 2 - PRODUCTS

2.1 OUTDOOR UNIT

A. Outdoor units shall be complete, including cabinet, hermetic compressor, nonferrous condenser coil with guard, condenser fan and motor, refrigerant reservoir or receiver, charging valve, controls, refrigerant holding charge, heavy duty permanently lubricated motors with built-in thermal overload protection, locked rotor, over and under voltage protection, high pressure cutout with auto-reset, motor starters and contactors, compressor protection, crankcase heater, transformer, filter/drier, vibration isolation, and other required components. Casings shall be constructed of zinc-coated steel, double phosphatized and finished with baked enamel for positive weatherproof protection. Removable panels shall provide access to all components from one side of the unit. Drain holes shall be provided in the base for positive drainage. Compressor shall be capable of operation down to 10 degrees F ambient and shall have a 5-year warranty.

2.2 INDOOR UNIT

A. Air handling evaporator unit shall be complete, including cabinet, nonferrous DX cooling coil, centrifugal fans, drives, permanently lubricated motors with thermal overload protection, 1" thick permanent filter(s), expansion valves, solenoid valves, refrigerant charge, insulated galvanized drain pan and other required components. Casings shall be constructed of heavy gauge steel, zinc coated to prevent corrosion and be painted with baked enamel and internally insulated with glass fiber material.

PART 3 - EXECUTION

3.1 GENERAL

A. High wall mount type cabinet

B. Units shall be installed as shown on the Drawings and in strict accordance with manufacturer’s recommendations.
C. For roof mounting, provide equipment supports, (minimum two) for each condensing unit with integral flashing cant. Equipment rail as manufactured by Roof Products and Systems Corp. or equal by Pate or Thycurb. Secure condensing unit to equipment support.

D. Condensing units shall be installed level.

E. Units shall be installed to allow adequate service to all components.

END OF SECTION
PART 1 - GENERAL

1.1 DESCRIPTION

A. Furnish and install all materials, labor, accessories, etc. shown on the Drawings and specified herein to completely install all piping systems.


1.2 RELATED DOCUMENTS

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

1.3 RELATED REFERENCES


PART 2 - PRODUCTS

2.1 REFRIGERANT PIPING

A. Piping shall be:

1. Type “L” hard drawn seamless copper tube conforming to ASTM B88, or
2. Type “ACR” (Air Conditioning Refrigeration) service copper tubing conforming to ASTM B280.

a. Annealed coils shall be dehydrated, purged with Nitrogen and tightly capped to insure cleanliness. Piping shall be engineered and constructed to support R-410A to 700 psi @ 250°F.

B. Fittings shall be wrought copper conforming to ASME/ANSI Standard B16.

C. Joints shall be brazed. Brazing filler metals shall comply with AWS A5.8.

D. Valves, filter-driers and other accessories shall be suitable for refrigerant service.

2.2 INSULATION

A. Refrigerant piping shall be insulated with flexible elastomeric tubing insulation, AP Armaflex Pipe Insulation manufactured by Armacel or equal. Where possible, insulation shall be slid over piping from one end before pipe ends are joined and shall not be slit or cut. All joints and seams shall be sealed weather-tight.
B. Insulation thickness shall be as follows:

IECC 2009 Commercial

1. Mini-Split Cooling Only (TXV located at outdoor unit) – Insulate all piping – 1/2" insulation

C. Finish coat for flexible elastomeric insulation installed outdoors shall be water-based latex enamel designed for use over all forms of flexible elastomeric insulation. Finish coat shall provide a protective finish suitable to both indoor and outdoor applications, formulated for cold weather flexibility to resist cracking and weather-resistant to ultraviolet (UV) and ozone. Coating shall be Armaflex WB Finish or equivalent.

PART 3 - EXECUTION

3.1 GENERAL

A. Refrigerant piping shall be supported as shown on the Drawings and as required at intervals not over 8'-0" O.C. and at all turns and offsets. Hangers and pipe clamps shall be copper plated tubing hangers of adequate size to fit around tubing and insulation as required. Saddles shall be used under insulated tubing to protect insulation. Piping routed in excess of 6 (six) lineal feet on the roof shall be supported by B-Line “Dura-Blok” rooftop supports or approved equal.

B. Pressure testing of piping systems shall be in accordance with standard industry practice for the refrigerant used.

C. Refrigerant piping shall be clean and free of outside contaminants at all times. Prior to start-up of any equipment or insulation installation, all piping shall be cleaned, tested, dehydrated and charged as recommended by the refrigerant compressor manufacturer.

1. Procedure: Joints and connections in refrigerant piping shall not be installed in partitions or walls or where inaccessible for testing, inspection and rework. Make provisions to prevent contact of dissimilar metals. During construction, cap all tubing to prevent moisture from entering. Keep in dry location.

2. Leak testing and recharging: Upon completion of installation of air conditioning equipment, test all refrigerant piping, components and accessories, including quick-connect refrigerant connectors for evaporator and condensing unit; test with a halide torch; prove tight by Contractor to assure a leak-tight refrigerant system. If leaks are detected at the time of installation or during warranty period, remove entire refrigerant charge from system, correct leaks, and retest system. After system is found to be leak free, evacuation shall be accomplished by use of a reliable gauge and a vacuum pump capable of pulling vacuum of at least one mm Hg absolute. Accomplish system evacuation in strict accordance with equipment manufacturer’s printed instruction. System leak testing, evacuation, dehydration and charging with refrigerant shall comply with standard industry practice and local codes and ordinances.

D. All joints in refrigerant piping shall be made accessible. Joints shall not be permitted below concrete.
E. All piping shall be run true to grade and shall be arranged to make the best possible appearance. Except where otherwise required by conditions of installation, all piping shall be symmetrical and parallel with lines of buildings or structure in which it is installed. All piping shall be run concealed except in mechanical room and where indicated otherwise.

F. All piping and equipment shall be supported and guided. Anchors shall be provided to absorb or transmit thrust and eliminate vibration or pulsation. Hangers or supports shall be provided near each change of direction. Supports shall be so located or shall be of such type as not to unduly restrict the movement of the pipe due to lateral or longitudinal expansion.

END OF SECTION
PART 1 - GENERAL

1.1 DESCRIPTION

A. All work in this section shall be subject to the provisions of Section 15000 - HVAC General.

B. Furnish and install factory assembled, piped and wired single package rooftop heat pumps of the type, operational characteristics and capacity as shown and scheduled and as specified herein. All rooftop units shall be by the same manufacturer. The manufacturer shall have available factory trained service engineers and an inventory of replacement parts within a 100-mile radius of the job site.

C. Acceptable manufacturers are Carrier, Trane and Lennox.

D. Compressor shall be warranted against parts failure for five (5) years.

E. Submit catalog cuts, certified performance data, and dimensional data.

PART 2 - PRODUCTS

2.1 EQUIPMENT AND MATERIALS

A. Unit shall be designed specifically for outdoor installation with all exterior surfaces of phosphatized, zinc-coated steel with primer and baked enamel finish. All components, including accessories shall be contained within the unit.

B. Access to internal components shall be afforded by removable gasketed access panels with quick release latches and lifting handles.

C. Unit shall have factory installed lifting lugs capable of accepting standard lifting slings and spreader bars to facilitate hoisting.

D. Electrical power connections shall be to a single point.

E. Unit shall be insulated with a minimum of 1", 1-pound density glass fiber insulation mat-faced.

F. Unit shall be designed for curb mounting and mate with a full perimeter roof curb for a complete weather tight seal. Curb shall be a minimum of 12" high or as shown on schedule and manufactured of 12-gauge zinc-coated steel and be supplied by the unit manufacturer with wood nailer strip and full perimeter gasket. Unit sides shall overhang the curb to form protective drip lip. Supply and return ducts shall connect to the curb prior to placement of the unit. Provide Kinetics Noise Control, Inc. “KIP Model 22-R”; 1" thick fiberglass pad continuously between RTU and curb.

2.2 HEATING SECTION

A. Provide an open wire electric heating coil with thermal high limit cut-outs and over current protection. Units with electric heat shall have a single point power connection.
2.3 COMPRESSOR

A. Fully hermetic scroll compressor(s) shall be provided with capacity reduction of a minimum of 50% on units 7½ tons and larger.

B. A crankcase heater shall be provided and wired to be active continuously.

C. The compressor shall be provided with spring isolators and flexible discharge line and hot gas muffler.

D. Motor shall be specifically designed for operation within a refrigeration atmosphere. Inlet screens shall be provided. Motor shall be capable of starting and continuously operating at ambient temperatures as high as 120 degrees F. Motor shall have overload protection and internal thermostats.

E. Compressor motor shall be capable of withstanding voltage fluctuations of plus or minus 10% of name plated voltage.

2.4 REFRIGERANT CIRCUIT

A. The unit shall be certified as complying with AHRI Standard 210/240 or 340/360 and bear the AHRI seal.

B. The indoor coil shall be constructed of 3/8" O.D. copper tubes mechanically bonded to aluminum plate fins and be pressure and leak tested at 425 psig. Outdoor fans shall be statically and dynamically balanced. Fan motors shall be UL Listed for outdoor use, have built-in thermal overload protection and permanently lubricated bearings. Condensing section shall be designed for a maximum of 130 degrees F condensing temperature with ambient air at 95 degrees F. Coil shall be circuited for sub-cooling.

C. Unit shall incorporate an insulated and sealed drain pan with threaded drain connections at each end of the unit. The Contractor shall install P-traps.

D. Refrigeration controls shall include as a minimum, high and low pressure control, compressor winding thermostat and overload, lockout circuit re-settable at the unit thermostat, contactors for condenser/evaporator fans and compressor, 24 volt control power transformer, reversing valve, defrost cycle and emergency heat.

E. Unit shall ship with an operating charge of R-410A.

2.5 INDOOR FANS

A. Indoor fans shall be direct driven or belt driven forward curved type with an adjustable sheave and motor sized to meet the air flow and static pressure as scheduled on the Drawings.

B. Fan assembly shall be isolated from the unit on rubber-in-shear or spring type isolators.

C. Motor shall have thermal overload protection and motor and fan bearings shall be permanently lubricated.

D. Fan wheel shall be protected from corrosion with a painted finish.
2.6 FILTERS

A. Two (2) sets of 2" low velocity filters shall be provided with the unit. Filters shall be MERV 8, pleated, disposable type equal to Farr 30/30 or as scheduled.

B. Only one size filter per unit is allowed.

C. During construction, the initial set of filters will be installed along with temporary media consisting of two plies of polyester fibers; 1¼" (32mm) thick with a non-migrating tackified surface having a MERV 8 rating.
   1. For non-ducted (plenum return) systems, use roll filter media over each inlet duct.
   2. For ducted systems, use precut pads with holding frames installed at each return air register or grille.

2.7 ACCESSORIES TO BE PROVIDED

A. Accessories noted below may or may not be required for equipment scheduled. Refer to the equipment schedules on the drawings for specific accessory requirements.

B. Programmable/Lockable Averaging Thermostat/Humidistat with Interlocked Temperature/Humidity Sensor.

C. Non-fused disconnect switch.

D. Low leakage dampers.

E. Outside air intake hood with inlet screen.

F. Anti-cycling timer to provide 5-minute delay between compressor shut-down and restart.

G. Head pressure controls to allow compressor operation to 0°F.

H. Roof curb.

I. Enthalpy controlled economizer cycle with minimum position rheostat including dampers with modulating controllers and spring return operators.

J. DDC system communicating controller.

K. Hail Guards.

L. Phase Monitor (3 phase units only)

PART 3 - EXECUTION

3.1 EQUIPMENT

A. Unit shall be shipped with a full refrigerant charge.

B. Unit shall be run tested at factory before shipping.
3.2 INSTALLATION

A. Unit to be installed level with manufacturer’s recommendations.

B. The second set of filters shall be installed after testing and balancing has been completed.

END OF SECTION
PART 1 - GENERAL

1.1 GENERAL REQUIREMENTS

A. Related Documents

1. All work of this Division shall be coordinated and provided by the single Building Management System (BMS) Contractor.
2. The work of this Division shall be scheduled, coordinated, and interfaced with the associated work of other trades. Reference the Division 15 Sections for details.
3. The work of this Division shall be as required by the Specifications, Point Schedules and Drawings.
4. If the BMS Contractor believes there are conflicts or missing information in the project documents, the Contractor shall promptly request clarification and instruction from the design team.

B. Definitions

1. Analog: A continuously variable system or value not having discrete levels. Typically exists within a defined range of limiting values.
2. Binary: A two-state system where an "ON" condition is represented by one discrete signal level and an "OFF" condition is represented by a second discrete signal level.
3. Building Management System (BMS): The total integrated system of fully operational and functional elements, including equipment, software, programming, and associated materials, to be provided by this Division BMS Contractor and to be interfaced to the associated work of other related trades.
4. BMS Contractor: The single Contractor to provide the work of this Division. This Contractor shall be the primary manufacturer, installer, commissioner and ongoing service provider for the BMS work.
5. Control Sequence: A BMS pre-programmed arrangement of software algorithms, logical computation, target values and limits as required to attain the defined operational control objectives.
6. Direct Digital Control: The digital algorithms and pre-defined arrangements included in the BMS software to provide direct closed-loop control for the designated equipment and controlled variables. Inclusive of Proportional, Derivative and Integral control algorithms together with target values, limits, logical functions, arithmetic functions, constant values, timing considerations and the like.
7. BMS Network: The total digital on-line real-time interconnected configuration of BMS digital processing units, workstations, panels, sub-panels, controllers, devices and associated elements individually known as network nodes. May exist as one or more fully interfaced and integrated sub-networks, LAN, WAN or the like.
9. BMS Integration: The complete functional and operational interconnection and interfacing of all BMS work elements and nodes in compliance with all applicable codes, standards and ordinances so as to provide a single coherent BMS as required by this Division.
10. Provide: The term "Provide" and its derivatives when used in this Division shall mean to furnish, install in place, connect, calibrate, test, commission, warrant, document and supply the associated required services ready for operation.
11. PC: Personal Computer from a recognized major manufacturer
12. Furnish: The term "Furnish" and its derivatives when used in this Division shall mean supply at the BMS Contractor's cost to the designated third party trade
contractor for installation. BMS Contractor shall connect furnished items to the BMS, calibrate, test, commission, warrant and document.

13. Wiring: The term “Wiring” and its derivatives when used in this Division shall mean provide the BMS wiring and terminations.

14. Install: The term “Install” and its derivatives when used in this Division shall mean receive at the jobsite and mount.

15. Protocol: The term “protocol” and its derivatives when used in this Division shall mean a defined set of rules and standards governing the on-line exchange of data between BMS network nodes.

16. Software: The term “software” and its derivatives when used in this Division shall mean all of programmed digital processor software, preprogrammed firmware and project specific digital process programming and database entries and definitions as generally understood in the BMS industry for real-time, on-line, integrated BMS configurations.

17. The use of words in the singular in these Division documents shall not be considered as limiting when other indications in these documents denote that more than one such item is being referenced.

18. Headings, paragraph numbers, titles, shading, bolding, underscores, clouds and other symbolic interpretation aids included in the Division documents are for general information only and are to assist in the reading and interpretation of these Documents.

19. The following abbreviations and acronyms may be used in describing the work of this Division:

ADC - Analog to Digital Converter
AHJ - Authority Having Jurisdiction
AI - Analog Input
AN - Application Node
ANSI - American National Standards Institute
AO - Analog Output
ASCII - American Standard Code for Information Interchange
ASHRAE - American Society of Heating, Refrigeration and Air Conditioning Engineers
AWG - American Wire Gauge
CPU - Central Processing Unit
CRT - Cathode Ray Tube
DAC - Digital to Analog Converter
DDC - Direct Digital Control
DI - Digital Input
DO - Digital Output
EEPROM - Electronically Erasable Programmable Read Only Memory
EMI - Electromagnetic Interference
FAS - Fire Alarm Detection and Annunciation System
GUI - Graphical User Interface
HOA - Hand-Off-Auto
ID - Identification
IEEE - Institute of Electrical and Electronics Engineers
I/O - Input/Output
IT - Information Technology
LAN - Local Area Network
LCD - Liquid Crystal Display
LED - Light Emitting Diode
MCC - Motor Control Center
C. BMS Description

1. The Building Management System (BMS) shall be a complete system designed for use with the enterprise IT systems. This functionality shall extend into the equipment rooms. Devices residing on the automation network located in equipment rooms and similar shall be fully IT compatible devices that mount and communicate directly on the IT infrastructure in the facility. Contractor shall be responsible for coordination with the owner’s IT staff to ensure that the BMS will perform in the owner’s environment without disruption to any of the other activities taking place on that LAN.

2. All points of user interface shall be on standard PCs that do not require the purchase of any special software from the BMS manufacturer for use as a building operations terminal. The primary point of interface on these PCs will be a standard Web Browser.

3. The work of the single BMS Contractor shall be as defined individually and collectively in all Sections of this Division specification together with the associated Point Sheets and Drawings and the associated interfacing work as referenced in the related documents.

4. The BMS work shall consist of the provision of all labor, materials, tools, equipment, software, software licenses, software configurations and database entries, interfaces, wiring, tubing, installation, labeling, engineering, calibration, documentation, samples, submittals, testing, commissioning, training services, permits and licenses, transportation, shipping, handling, administration, supervision, management, insurance, temporary protection, cleaning, cutting and patching, warranties, services, and items, even though these may not be specifically mentioned in these Division documents which are required for the complete, fully functional and commissioned BMS.
D. Quality Assurance

1. General

   a. The Building Management System Contractor shall be the primary manufacturer-owned branch office that is regularly engaged in the engineering, programming, installation and service of total integrated Building Management Systems.
   b. The BMS Contractor shall be a recognized national manufacturer, installer and service provider of BMS.
   c. The BMS Contractor shall have a branch facility within a 100-mile radius of the job site supplying complete maintenance and support services on a 24 hour, 7-day-a-week basis.
   d. As evidence and assurance of the contractor’s ability to support the Owner’s system with service and parts, the contractor must have been in the BMS business for at least the last ten (10) years and have successfully completed total projects of at least 10 times the value of this contract in each of the preceding five years.
   e. The Building Management System architecture shall consist of the products of a manufacturer regularly engaged in the production of Building Management Systems, and shall be the manufacturer’s latest standard of design at the time of bid.

E. References

1. All work shall conform to the following Codes and Standards, as applicable:

   b. National Electric Code (NEC) and applicable local Electric Code.
   c. Underwriters Laboratories (UL) listing and labels.
   d. UL 864 UUKL Smoke Control
   e. UL 268 Smoke Detectors.
   f. UL 916 Energy Management
   g. NFPA 70 - National Electrical Code.
   h. NFPA 90A - Standard For The Installation Of Air Conditioning And Ventilating Systems.
   i. NFPA 92A and 92B Smoke Purge/Control Equipment.
   j. Factory Mutual (FM).
   l. National Electric Manufacturer’s Association (NEMA).
   m. American Society of Mechanical Engineers (ASME).
   n. American Society of Heating, Refrigerating and Air Conditioning Engineers (ASHRAE).
   o. Air Movement and Control Association (AMCA).
   p. Institute of Electrical and Electronic Engineers (IEEE).
   r. Electronics Industries Association (EIA).
   s. Occupational Safety and Health Administration (OSHA).
   v. Americans Disability Act (ADA)
HEATING, VENTILATING AND AIR CONDITIONING AUTOMATIC CONTROLS
DIVISION 15 SECTION 15150

w. ANSI/EIA 909.1-A-1999 (LonWorks)
x. ANSI/ASHRAE Standard 195-2008 (BACnet)

2. In the case of conflicts or discrepancies, the more stringent regulation shall apply.
3. All work shall meet the approval of the Authorities Having Jurisdiction at the project site.

F. Work By Others
1. The demarcation of work and responsibilities between the BMS Contractor and other related trades shall be as outlined in the BMS RESPONSIBILITY MATRIX

<table>
<thead>
<tr>
<th>BMS RESPONSIBILITY MATRIX</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>WORK</strong></td>
</tr>
<tr>
<td>BMS low voltage and communication wiring</td>
</tr>
<tr>
<td>VAV box nodes</td>
</tr>
<tr>
<td>BMS conduits and raceway</td>
</tr>
<tr>
<td>Automatic dampers</td>
</tr>
<tr>
<td>Manual valves</td>
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<tr>
<td>Automatic valves</td>
</tr>
<tr>
<td>VAV boxes</td>
</tr>
<tr>
<td>Pipe insertion devices and taps including thermowells, flow and pressure stations</td>
</tr>
<tr>
<td>BMS Current Switches.</td>
</tr>
<tr>
<td>BMS Control Relays</td>
</tr>
<tr>
<td>Power distribution system monitoring interfaces</td>
</tr>
<tr>
<td>Control air compressors</td>
</tr>
<tr>
<td>Concrete and/or inertia equipment pads and seismic bracing</td>
</tr>
<tr>
<td>BMS interface with Chiller controls</td>
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<tr>
<td>Chiller controls interface with BMS</td>
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<tr>
<td>BMS interface with Classroom unit controls</td>
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<tr>
<td>Classroom unit controls interface with BMS</td>
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<tr>
<td>ADD OTHER THIRD PARTY EQUIPMENT HERE</td>
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<tr>
<td>All BMS Nodes, equipment, housings, enclosures and panels.</td>
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<tr>
<td>Smoke Detectors</td>
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<tr>
<td>Fire/Smoke Dampers</td>
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<tr>
<td>Fire Dampers</td>
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<tr>
<td>Chiller Flow Switches</td>
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<tr>
<td>Boiler wiring</td>
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<tr>
<td>Water treatment system</td>
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<tr>
<td>VFDs</td>
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<tr>
<td>Refrigerant monitors</td>
</tr>
<tr>
<td>Computer Room A/C Unit field-mounted controls</td>
</tr>
<tr>
<td>Description</td>
</tr>
<tr>
<td>-------------------------------------------------</td>
</tr>
<tr>
<td>Fire Alarm shutdown relay interlock wiring</td>
</tr>
<tr>
<td>Fire Alarm smoke control relay interlock wiring</td>
</tr>
<tr>
<td>Fireman’s Smoke Control Override Panel</td>
</tr>
<tr>
<td>Fan Coil Unit controls</td>
</tr>
<tr>
<td>Unit Heater controls</td>
</tr>
<tr>
<td>Packaged RTU space mounted controls</td>
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<tr>
<td>Packaged RTU factory-mounted controls</td>
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<tr>
<td>Packaged RTU field-mounted controls</td>
</tr>
<tr>
<td>Cooling Tower Vibration Switches</td>
</tr>
<tr>
<td>Cooling Tower Level Control Devices</td>
</tr>
<tr>
<td>Cooling Tower makeup water control devices</td>
</tr>
<tr>
<td>Pool Dehumidification Unit Controls</td>
</tr>
<tr>
<td>Starters, HOA switches</td>
</tr>
<tr>
<td>Control damper actuators</td>
</tr>
</tbody>
</table>

2. Submittals
3. Shop Drawings, Product Data, and Samples

   a. The BMS contractor shall submit a list of all shop drawings with submittals dates within 30 days of contract award.
   b. Submittals shall be in defined packages. Each package shall be complete and shall only reference itself and previously submitted packages. The packages shall be as approved by the Architect and Engineer for Contract compliance.
   c. Allow 15 working days for the review of each package by the Architect and Engineer in the scheduling of the total BMS work.
   d. Equipment and systems requiring approval of local authorities must comply with such regulations and be approved. Filing shall be at the expense of the BMS Contractor where filing is necessary. Provide a copy of all related correspondence and permits to the Owner.
   e. Prepare an index of all submittals and shop drawings for the installation. Index shall include a shop drawing identification number, Contract Documents reference and item description.
   f. The BMS Contractor shall correct any errors or omissions noted in the first review.
   g. At a minimum, submit the following:

      1) BMS network architecture diagrams including all nodes and interconnections.
      2) Systems schematics, sequences, and flow diagrams.
      3) Points schedule for each point in the BMS, including: Point Type, Object Name, Expanded ID, Display Units, Controller type, and Address.
      4) Samples of Graphic Display screen types and associated menus.
      5) Detailed Bill of Material list for each system or application, identifying quantities, part numbers, descriptions, and optional features.
      6) Control Damper Schedule including a separate line for each damper provided under this section and a column for each of the damper attributes, including: Code Number, Fail Position, Damper Type, Damper Operator, Duct Size, Damper Size, Mounting, and Actuator Type.
7) Room Schedule including a separate line for each VAV box and/or terminal unit indicating location and address
8) Control Valve Schedules including a separate line for each valve provided under this section and a column for each of the valve attributes: Code Number, Configuration, Fail Position, Pipe Size, Valve Size, Body Configuration, Close off Pressure, Capacity, Valve CV, Design Pressure, and Actuator Type.
9) Details of all BMS interfaces and connections to the work of other trades.
10) Product data sheets or marked catalog pages including part number, photo and description for all products including software.

G. Record Documentation

1. Operation and Maintenance Manuals
   a. Three (3) copies of the Operation and Maintenance Manuals shall be provided to the Owner's Representative upon completion of the project. The entire Operation and Maintenance Manual shall be furnished on Compact Disc media, and include the following for the BMS provided:
      1) Table of contents.
      2) As-built system record drawings. Computer Aided Drawings (CAD) record drawings shall represent the as-built condition of the system and incorporate all information supplied with the approved submittal.
      3) Manufacturer's product data sheets or catalog pages for all products including software.
      4) System Operator's manuals.
      5) Archive copy of all site-specific databases and sequences.
      6) BMS network diagrams.
      7) Interfaces to all third-party products and work by other trades.

2. On-Line documentation: After completion of all tests and adjustments the contractor shall provide a copy of all as-built information and product data to be installed on a customer designated computer workstation or server

H. Warranty

1. Standard Material and Labor Warranty:
   a. Provide a one-year labor and material warranty on the BMS.
   b. If within twelve (12) months from the date of acceptance of product, upon written notice from the owner, it is found to be defective in operation, workmanship or materials, it shall be replaced, repaired or adjusted at the option of the BMS Contractor at the cost of the BMS Contractor.
   c. Maintain an adequate supply of materials within 100 miles of the Project site such that replacement of key parts and labor support, including programming. Warranty work shall be done during BMS Contractor's normal business hours.
PART 2 - PRODUCTS

2.1 GENERAL

A. General Description

1. The Building Management System (BMS) shall use an open architecture and fully support a multi-vendor environment. To accomplish this effectively, the BMS shall support open communication protocol standards and integrate a wide variety of third-party devices and applications. The system shall be designed for use on the Internet, or intranets using off the shelf, industry standard technology compatible with other owner provided networks.

2. The Building Management System shall consist of the following:
   a. Standalone Network Automation Engine(s)
   b. Field Equipment Controller(s)
   c. Input/Output Module(s)
   d. Local Display Device(s)
   e. Portable Operator's Terminal(s)
   f. Distributed User Interface(s)
   g. Network processing, data storage and communications equipment
   h. Other components required for a complete and working BMS

3. The system shall be modular in nature, and shall permit expansion of both capacity and functionality through the addition of sensors, actuators, controllers and operator devices, while re-using existing controls equipment.

4. System architectural design shall eliminate dependence upon any single device for alarm reporting and control execution.
   a. The failure of any single component or network connection shall not interrupt the execution of control strategies at other operational devices.
   b. The System shall maintain all settings and overrides through a system reboot.

5. System architectural design shall eliminate dependence upon any single device for alarm reporting and control execution.

   a. The System shall comply with the following NFPA Codes and Standards as applicable:
      1) NFPA 70 National Electrical Code
      2) NFPA 72 National Fire Alarm Code
      3) NFPA 101 Life Safety Code
      4) NFPA 90A Standard for the Installation of Air-Conditioning and Ventilation Systems
      5) NFPA 92B Guide for Smoke Management Systems in Malls, Atria, and Large Areas
b. The System shall comply with the following International Code Council (ICC) Codes:

1) Building Officials and code Administrators International (BOMA) model code
2) International Conference of Building Officials (ICBO) model code
3) Southern Building Code Congress International (SBCCI) regulations

c. Acceptable Manufacturers

1) Johnson Controls, Inc., Metasys (Basis of design)
2) Trane
3) Carrier

B. BMS Architecture

1. Automation Network

a. The automation network shall be based on a PC industry standard of Ethernet TCP/IP. Where used, LAN controller cards shall be standard “off the shelf” products available through normal PC vendor channels.

b. The BMS shall network multiple user interface clients, automation engines, system controllers and application-specific controllers. Provide application and data server(s) as required for systems operation.

c. All BMS devices on the automation network shall be capable of operating at a communication speed of 100 Mbps, with full peer-to-peer network communication.

d. Network Automation Engines (NAE) shall reside on the automation network.

e. The automation network will be compatible with other enterprise-wide networks. Where indicated, the automation network shall be connected to the enterprise network and share resources with it by way of standard networking devices and practices.

2. Control Network

a. Network Automation Engines (NAE) shall provide supervisory control over the control network and shall support all three (3) of the following communication protocols:

1) BACnet Standard MS/TP Bus Protocol ASHRAE SSPC-135, Clause 9
   a) The NAE shall be BACnet Testing Labs (BTL) certified and carry the BTL Label.
   b) The NAE shall be tested and certified as a BACnet Building Controller (B-BC).

2) LonWorks enabled devices using the Free Topology Transceiver (FTT-10a).

3) The Johnson Controls N2 Field Bus.

b. Control networks shall provide either “Peer-to-Peer,” Master-Slave, or Supervised Token Passing communications, and shall operate at a minimum communication speed of 9600 baud.
c. DDC Controllers shall reside on the control network.
e. A BACnet Protocol Implementation Conformance Statement (PICS) shall be provided for each controller device (master or slave) that will communicate on the BACnet MS/TP Bus.
f. The PICS shall be submitted 10 days prior to bidding.

C. User Interface

1. Dedicated Web Based User Interface

a. Where indicated on plans the BMS Contractor shall provide and install a personal computer for command entry, information management, network alarm management, and database management functions. All real-time control functions, including scheduling, history collection and alarming, shall be resident in the BMS Network Automation Engines to facilitate greater fault tolerance and reliability.
b. Dedicated User Interface Architecture – The architecture of the computer shall be implemented to conform to industry standards, so that it can accommodate applications provided by the BMS Contractor and by other third party applications suppliers, including but not limited to Microsoft Office Applications. Specifically it must be implemented to conform to the following interface standards.

1) Microsoft Internet Explorer for user interface functions
2) Microsoft Office Professional for creation, modification and maintenance of reports, sequences other necessary building management functions
3) Microsoft Outlook or other e-mail program for supplemental alarm functionality and communication of system events, and reports
4) Required network operating system for exchange of data and network functions such as printing of reports, trends and specific system summaries

2. Distributed Web Based User Interface

a. All features and functions of the dedicated user interface previously defined in this document shall be available on any computer connected directly or via a wide area or virtual private network (WAN/VPN) to the automation network and conforming to the following specifications.
b. The software shall run on the Microsoft Internet Explorer (6.0 or higher) browser supporting the following functions:

1) Configuration
2) Commissioning
3) Data Archiving
4) Monitoring
5) Commanding
6) System Diagnostics
PART 3 - EXECUTION

3.1 PERFORMANCE/EXECUTION

A. BMS Specific Requirements

1. Graphic Displays
   a. Provide a color graphic system flow diagram display for each system with all
      points as indicated on the point list. All terminal unit graphic displays shall
      be from a standard design library.
   b. User shall access the various system schematics via a graphical penetration
      scheme and/or menu selection.

2. Custom Reports:
   a. Provide custom reports as required for this project

3. Actuation / Control Type
   a. Primary Equipment
      1) Controls shall be provided by equipment manufacturer as specified
         herein.
      2) All damper and valve actuation shall be electric.
   b. Air Handling Equipment
      1) All air handlers shall be controlled with a HVAC-DDC Controller
      2) All damper and valve actuation shall be electric.
   c. Terminal Equipment:
      1) Terminal Units (VAV, UV, etc.) shall have electric damper and valve
         actuation.
      2) All Terminal Units shall be controlled with HVAC-DDC Controller

B. Installation Practices

1. BMS Wiring
   a. All conduit, wiring, accessories and wiring connections required for the
      installation of the Building Management System, as herein specified, shall
      be provided by the BMS Contractor unless specifically shown on the
      Electrical Drawings under Division 16 Electrical. All wiring shall comply with
      the requirements of applicable portions of Division 16 and all local and
      national electric codes, unless specified otherwise in this section.
   b. All BMS wiring materials and installation methods shall comply with BMS
      manufacturer recommendations.
   c. The sizing, type and provision of cable, conduit, cable trays, and raceways
      shall be the design responsibility of the BMS Contractor. If complications
      arise, however, due to the incorrect selection of cable, cable trays, raceways
and/or conduit by the BMS Contractor, the Contractor shall be responsible for all costs incurred in replacing the selected components.

d. Class 2 Wiring

1) All Class 2 (24VAC or less) wiring shall be installed in conduit unless otherwise specified.

2) Conduit is not required for Class 2 wiring in concealed accessible locations. Class 2 wiring not installed in conduit shall be supported every 5’ from the building structure utilizing metal hangers designed for this application. Wiring shall be installed parallel to the building structural lines. All wiring shall be installed in accordance with local code requirements.

e. Class 2 signal wiring and 24VAC power can be run in the same conduit. Power wiring 120VAC and greater cannot share the same conduit with Class 2 signal wiring.

f. Provide for complete grounding of all applicable signal and communications cables, panels and equipment so as to ensure system integrity of operation. Ground cabling and conduit at the panel terminations. Avoid grounding loops.

2. BMS Line Voltage Power Source

a. 120-volt AC circuits used for the Building Management System shall be taken from panel boards and circuit breakers provided by Division 16.

b. Circuits used for the BMS shall be dedicated to the BMS and shall not be used for any other purposes.

c. DDC terminal unit controllers may use AC power from motor power circuits.

3. BMS Raceway

a. All wiring shall be installed in conduit or raceway except as noted elsewhere in this specification. Minimum control wiring conduit size 1/2”.

b. Where it is not possible to conceal raceways in finished locations, surface raceway (Wiremold) may be used as approved by the Architect.

c. All conduits and raceways shall be installed level, plumb, at right angles to the building lines and shall follow the contours of the surface to which they are attached.

d. Flexible Metal Conduit shall be used for vibration isolation and shall be limited to 3 feet in length when terminating to vibrating equipment. Flexible Metal Conduit may be used within partition walls. Flexible Metal Conduit shall be UL listed.

4. Penetrations

a. Provide fire stopping for all penetrations used by dedicated BMS conduits and raceways.

b. All openings in fire proofed or fire stopped components shall be closed by using approved fire resistive sealant.

c. All wiring passing through penetrations, including walls shall be in conduit or enclosed raceway.

d. Penetrations of floor slabs shall be by core drilling. All penetrations shall be plumb, true, and square.
5. BMS Panel Installation
   a. The BMS panels and cabinets shall be located as indicated at an elevation of not less than 2 feet from the bottom edge of the panel to the finished floor. Each cabinet shall be anchored per the manufacturer’s recommendations.
   b. The BMS contractor shall be responsible for coordinating panel locations with other trades and electrical and mechanical contractors.

6. Input Devices
   a. All Input devices shall be installed per the manufacturer recommendation.
   b. Locate components of the BMS in accessible local control panels wherever possible.

7. HVAC Input Devices – General
   a. All Input devices shall be installed per the manufacturer recommendation.
   b. Locate components of the BMS in accessible local control panels wherever possible.
   c. The mechanical contractor shall install all in-line devices such as temperature wells, pressure taps, airflow stations, etc.
   d. Input Flow Measuring Devices shall be installed in strict compliance with ASME guidelines affecting non-standard approach conditions.
   e. Outside Air Sensors
      1) Sensors shall be mounted on the North wall to minimize solar radiant heat impact or located in a continuous intake flow adequate to monitor outside air conditions accurately.
      2) Sensors shall be installed with a rain proof, perforated cover.
   f. Duct Temperature Sensors:
      1) Duct mount sensors shall mount in an electrical box through a hole in the duct and be positioned so as to be easily accessible for repair or replacement.
      2) The sensors shall be insertion type and constructed as a complete assembly including lock nut and mounting plate.
      3) For ductwork greater in any dimension than 48 inches or where air temperature stratification exists such as a mixed air plenum, utilize an averaging sensor.
      4) The sensor shall be mounted to suitable supports using factory approved element holders.
   g. Space Sensors:
      1) Shall be mounted per ADA requirements.
   h. All output devices shall be installed per the manufacturers recommendation. The mechanical contractor shall install all in-line devices such as control valves, dampers, airflow stations, pressure wells, etc.
   i. Actuators: All control actuators shall be sized capable of closing against the maximum system shut-off pressure. The actuator shall modulate in a
smooth fashion through the entire stroke. When any pneumatic actuator is sequenced with another device, pilot positioners shall be installed to allow for proper sequencing.

j. Control Dampers: Shall be opposed blade for modulating control of airflow. Parallel blade dampers shall be installed for two position applications.

k. Control Valves: Shall be sized for proper flow control with equal percentage valve plugs. The maximum pressure drop for water applications shall be 5 PSI. The maximum pressure drop for steam applications shall be 7 PSI.

l. Electronic Signal Isolation Transducers: Whenever an analog output signal from the Building Management System is to be connected to an external control system as an input (such as a chiller control panel), or is to receive as an input a signal from a remote system, provide a signal isolation transducer. Signal isolation transducer shall provide ground plane isolation between systems. Signals shall provide optical isolation between systems.

C. Training

1. The BMS contractor shall provide the following training services:

   a. One day of on-site orientation by a system technician who is fully knowledgeable of the specific installation details of the project. This orientation shall, at a minimum, consist of a review of the project as-built drawings, the BMS software layout and naming conventions, and a walk through of the facility to identify panel and device locations.

END OF SECTION
A. Sequence of Operation

1. Rooftop Units (All RTUs unless specifically noted) – see attached points list for RTUs
   a. The Building Automation System (BAS) shall send the controller Occupied Bypass, Morning Warm-up / Pre-Cool, Occupied / Unoccupied and Heat / Cool modes. If a BAS communication is lost with the BAS the controller shall operate using default modes and setpoints.

b. Occupied Mode

1) During occupied periods, the supply fan shall run continuously and the outside air damper shall open to maintain minimum ventilation requirements. The DX cooling and gas heat shall stage to maintain the occupied space temperature setpoint.

2) If economizing is enabled the outside air damper shall modulate to maintain the occupied space temperature setpoint.

c. Unoccupied Mode

1) When the space temperature is below the unoccupied heating setpoint of 60.0 deg. F (adj.) the supply fan shall start, the outside air damper shall remain closed and the gas heat shall be enabled. When the space temperature rises above the unoccupied heating setpoint of 60.0 deg. F (adj.) plus the unoccupied differential of 4.0 deg. F (adj.) the supply fan shall stop and the gas heat shall be disabled.

2) When the space temperature is above the unoccupied cooling setpoint of 85.0 deg. F (adj.) the supply fan shall start, the outside air damper shall open if economizing is enabled and remain closed if economizing is disabled and the DX cooling shall be enabled. When the space temperature falls below the unoccupied cooling setpoint of 85.0 deg. F (adj.) minus the unoccupied differential of 4.0 deg. F (adj.) the supply fan shall stop, the DX cooling shall be disabled and the outside air damper shall close.

d. Optimal Start: The BAS shall monitor the scheduled occupied time, occupied space setpoints and space temperature to calculate when the optimal start occurs.

e. Morning Warm-Up Mode: During optimal start, if the space temperature is below the occupied heating setpoint a morning warm-up mode shall be activated. When morning warm-up is initiated the unit shall enable the heating and supply fan. The outside air damper shall remain closed. When the space temperature reaches the occupied heating setpoint (adj.), the unit shall transition to the occupied mode.

f. Pre-Cool Mode: During optimal start, if the space temperature is above the occupied cooling setpoint, pre-cool mode shall be activated. When pre-cool is initiated the unit shall enable the fan and cooling or economizer. The outside air damper shall remain closed, unless economizing. When the
space temperature reaches occupied cooling setpoint (adj.), the unit shall transition to the occupied mode.

g. Optimal Stop: The BAS shall monitor the scheduled unoccupied time, occupied setpoints and space temperature to calculate when the optimal stop occurs. When the optimal stop mode is active the unit controller shall maintain the space temperature to the space temperature offset setpoint.

h. Occupied Bypass: The BAS shall monitor the status of the “on” and “cancel” buttons of the space temperature sensor. When an occupied bypass request is received from a space sensor, the unit shall transition from its current occupancy mode to occupied bypass mode and the unit shall maintain the space temperature to the occupied setpoints (adj.).

i. Cooling Mode: The unit controller shall use space temperature and space temperature setpoint to determine when to initiate requests for cooling. When the space temperature rises above the setpoint, the unit controller shall modulate the economizer or stage the DX cooling as required to maintain the space temperature setpoint. The first compressor shall energize after its minimum 3-minute off time has expired. If additional cooling capacity is required the second stage of cooling shall be enabled. Once the space temperature falls below the setpoint the compressors shall be deactivated and the economizer shall return to minimum position.

j. Heating Mode: The unit controller shall use the space temperature and space temperature setpoint to determine when to initiate requests for heat. When the space temperature drops below the setpoint, the unit controller shall enable gas heating stages to maintain the space temperature setpoint. Once the space temperature rises above the setpoint the gas heating stages shall be disabled.

k. Dehumidification: (RTU-1, 2, 3)

1) Factory installed hot gas reheat shall allow application of dehumidification. Dehumidification shall be allowed only when the outside air temperature is above 40.0 deg. F and below 100.0 deg. F. The economizer outside air damper shall drive to minimum position during dehumidification.

2) Single compressor units: On a call for dehumidification, the reheat valve shall energize and the compressor shall enable. When the humidity control setpoint is satisfied, the valve shall be de-energized and the compressor shall be disabled. If there is a call for cooling from the space temperature controller, while in reheat, the reheat valve shall be de-energized and the compressor continues to run.

l. Economizer

1) The mixed air sensor shall measure the dry bulb temperature of the air leaving the evaporator coil while economizing. When economizing is enabled and the unit is operating in the cooling mode, the economizer damper shall be modulated between its minimum position and 100% to maintain the space temperature setpoint. The economizer damper shall modulate toward minimum position in the event the mixed air temperature falls below the low limit temperature setting. Compressors shall be delayed from operating until the economizer has opened to 100%.

2) Comparative Enthalpy: Outside air (OA) enthalpy shall be compared with Return air (RA) enthalpy point. The economizer shall enable
when OA enthalpy is less than RA enthalpy - 3.0 BTU/LB. The economizer shall disable when OA enthalpy is greater than RA enthalpy.

3) Demand Control Ventilation: When the demand control ventilation (DCV) threshold is reached, the economizer shall start to modulate open to bring in more fresh air to reduce the return air CO2 level. The damper shall modulate open in small increments until the CO2 level is satisfied or the damper reaches the full open position. Once the threshold is satisfied, the damper shall return to normal economizer operation. If the mixed air temperature drops to 40.0 deg. F, the CO2 sensor input is overridden and closes the damper to minimum position. When the mixed air temperature rises to 43.0 deg. F, CO2 or economizer operation is once again restored.

4) Supply Fan: The supply fan shall be enabled while in the occupied mode and cycled on during the unoccupied mode. A differential pressure switch shall monitor the differential pressure across the fan. If the switch does not open within 40 seconds after a request for fan operation a fan failure alarm shall be annunciated at the BAS, the unit shall stop, requiring a manual reset.

5) Building Pressure Control: The power exhaust shall enable when the economizer damper position is equal to or greater than the exhaust fan setpoint.

6) Filter Status: A differential pressure switch shall monitor the differential pressure across the filter when the fan is running. If the switch closes for 2 minutes after a request for fan operation a dirty filter alarm shall be annunciated at the BAS.

2. Energy Recovery Unit: (ERU-1)

   a. Unit shall be controlled via internal control system and shall operate 24/7 to maintain space temperature and humidity setpoints (adj). The ERU shall be provided with a programmable controller designed for space temperature and humidity control. Controller shall modulate the capacity of the compressor, modulate the NG heat, modulate the hot gas reheat coil and vary the speed of the condenser fans to maintain the set point conditions.

   b. Contractor shall install and wire one wall mounted humidity sensor and one wall mounted temperature sensor with adjustment capabilities of +/- 2F. Contractor shall install and wire unit supply air temperature sensor per the manufacturer’s requirements.

   c. BAS shall have following control of system:

      1) On/off
      2) Cooling setpoint – occupied/unoccupied
      3) Heating setpoint – occupied/unoccupied

   d. System shall communicate the following with the BAS

      1) OA temperature sensor.
      2) OA humidity sensor.
      3) SA temperature sensor.
      4) Space temperature (adjustable) sensor.
      5) Space humidity sensor.
      6) Suction pressure sensor.
7) Discharge pressure sensor.
8) Air flow sensor.

3. Exhaust Fans (EF-1, EF-2)
   a. Fans shall be controlled via wall CO/NO2 control system. See drawings.

4. Exhaust Fans (KEF-1, KSF-1)
   a. KEF-1 Fan shall be interlocked to switch on hood.
   b. KSF-1 fans shall be interlocked with KEF-1

5. Ductless Split systems: (FCU/CU-A)
   a. Unit shall be controlled via internal controller. Space shall be maintained at 68 deg. F (adj.)
   b. BAS shall have on/off control of system
   c. System shall communicate the following outputs to BAS
      1) Indoor Fan Status
      2) Outdoor Fan Status
      3) Compressor status
      4) Space Temperature

END OF SECTION
PART 1 - GENERAL

1.1 GENERAL REQUIREMENTS

A. All work specified herein shall be accomplished in accordance with the applicable requirements of Section 15000 - HVAC General.

1.2 WORK INCLUDED

A. The work done under this section shall include all labor, materials, accessories, services and equipment necessary to furnish and install all insulation, complete, as indicated on the Drawings and as specified herein.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Materials as specified in this section shall be manufactured by Armstrong, Johns-Manville, Knauf, Pittsburgh-Corning, Certainteed, Pabco, Dow Chemical, Owens Corning or approved equal.

B. Insulation thicknesses shall be as shown in the following table:

<table>
<thead>
<tr>
<th>Piping System Types</th>
<th>Fluid Temperature Range</th>
<th>Minimum Runouts</th>
<th>Insulation Thickness for Pipe Sizes</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>2 in. +</td>
<td>1 in. and Less</td>
</tr>
</tbody>
</table>

(Cooling Systems)

| Refrigerant or Brine | Below 4.5 | Below 40 | 1.5 | 1.5 | 1.5 | 1.5 | 1.5 | 1.5 |

+ Runouts to Individual Terminal Units (not exceeding 12 ft. in length)

* For chilled water piping located in attics and other unconditioned spaces (excluding return air plenums), increase the pipe insulation thickness by 1/2" for pipe sizes up through 8". Insulation for piping 10" and larger shall be 2-1/2" thick.

C. Unless noted otherwise, the abovementioned piping systems inside the building shall be insulated with a 5 lb/cu. ft. (nominal) density sectional fiberglass insulation with a thermal conductivity (k factor) not to exceed 0.24. The jacket shall be fire retardant with a suitable vapor barrier. All joints and seams shall be sealed vapor tight. All joints and seams shall be lapped in place to form a continuous vapor barrier covering. All seams shall then be covered with “All Service Jacket” (ASJ) 3” wide tape. The tape shall match the jacket. The tape shall be squeegeed in place to provide complete adhesion of the tape to the jacket and to provide a continuous vapor barrier covering. Exterior water piping shall be heat traced (Refer to Section 15052 - Piping and Accessories).

D. Piping installed outdoors shall be insulated with cellular glass insulation, Pittsburgh-Corning “Foamglas” or approved equal. Insulation thickness required to prevent condensation shall be determined by the manufacturer for worse case ambient conditions.
HEATING, VENTILATING AND AIR CONDITIONING

DIVISION 15

SECTION 15170

1. Install with all service jacket and in accordance with manufacturer’s recommendations.
2. Where heat tracing is specified, oversize insulation to allow space for heat tape.

E. Provide high density preformed pipe insulation inserts at all pipe hangers. Inserts shall be equal to Foamglas by Pittsburgh Corning or calcium silicate. Provide ribbed hanger saddles by Centerline, Buckaroos, Inc. or approved equal.

F. Ductwork
1. All supply air ducts with heated or cooled air shall be insulated. All return ducts in concealed and unheated areas shall be insulated.
2. Toilet and general exhaust ductwork exhausting air conditioned air and routed in attic spaces shall be insulated.
3. Ductwork described in 1. and 2. above shall be insulated with 2” thick fiberglass blanket type, 3/4 lb/cu. ft. with reinforced foil faced vapor barrier (R-5 min.). Insulation shall be securely adhered to ductwork. All joints shall be sealed with 3” wide strips of foil faced vapor barrier tape and applied to form a continuous vapor seal.
4. Ducts within mechanical rooms shall be insulated with 1” thick, 3 lb/cu. ft. rigid fiberglass board with an R factor of not less than 5 (K = 0.235 at 75 degrees F mean temperature) with reinforced foil vapor barrier. Insulation shall be secured to ductwork with stick pins and speed washers. All joints and stick pin terminations shall be sealed with 3” wide strips of vapor barrier material and applied to form a continuous vapor seal.

G. All outside air ducts shall be insulated. Outside air ducts located within mechanical rooms shall be rigid fiberglass board as described above. All other outside air ducts shall be blanket type insulated as described above.

H. Sheet metal supply, return, and outside air ductwork in non-air conditioned areas shall be insulated with 2” thick 1½” lb/cu. ft. fiberglass blanket duct insulation with foil faced vapor barrier (R-6 min.).

I. Exterior supply and return air ductwork shall be constructed of galvanized sheet metal lined with 2” thick 3 lb/cu. ft. duct liner board (R-8 min.). All seams shall be externally sealed watertight with a 20-year silicone caulk and coated with a rust preventive coating over the entire duct surface.

J. Provide insulating tape over all piping specialties to prevent condensation such as drain valves, drain plugs, combination temperature/pressure test plugs, etc.

K. All insulation must meet applicable codes for Flame Spread and Smoke developed ratings.

PART 3 - EXECUTION

3.1 INSTALLATION
A. Shop drawing submittals shall include a complete package of materials and methods intended for use as described in this section.
B. All work shall be in strict accordance with applicable codes, ordinances and the manufacturer’s recommendations.

C. All work shall be performed in a professional workmanlike manner and standard trade practice. It shall be smooth in appearance and suitable for finish painting.

D. All exterior piping shall be installed with a corrugated aluminum jacket with bands 3’-0” on center.

E. Fiberglass pipe insulation shall be applied to clean (free of rust) dry pipe prior to leak testing. Chilled and condenser water systems shall not be operated until the insulation is completely installed with a vapor barrier in place.

END OF SECTION
1.1 RELATED DOCUMENTS
A. Section 15000 HVAC General
B. Section 15855 Roof Curbs
C. Section 15950 Testing, Adjusting and Balancing
D. Section 15150 Automatic Controls

1.2 GENERAL DESCRIPTION
A. This section includes the design, controls and installation requirements for packaged rooftop units/heat pumps/outdoor air handling units.

1.3 QUALITY ASSURANCE
A. Packaged air-cooled condenser units shall be certified in accordance with ANSI/AHRI Standard 340/360 performance rating of commercial and industrial unitary air-conditioning and heat pump equipment.
B. Unit shall be certified in accordance with UL Standard 1995/CSA C22.2 No. 236, Safety Standard for Heating and Cooling Equipment.
C. Unit and refrigeration system shall comply with ASHRAE 15, Safety Standard for Mechanical Refrigeration.
D. Unit shall be certified in accordance with ANSI Z21.47b/CSA 2.3b and ANSI Z83.8/CSA 2.6, Safety Standard Gas-Fired Furnaces.
E. Unit Seasonal Energy Efficiency Ratio (SEER) shall be equal to or greater that prescribed by ASHRAE 90.1, Energy Efficient Design of New Buildings except Low-Rise Residential Buildings.
F. Unit shall be safety certified by ETL and ETL US listed. Unit nameplate shall include the ETL/ETL Canada label.

1.4 SUBMITTALS
A. Product Data: Literature shall be provided that indicates dimensions, operating and shipping weights, capacities, ratings, fan performance, filter information, factory supplied accessories, electrical characteristics and connection requirements. Installation, Operation and Maintenance manual with startup requirements shall be provided.
B. Shop Drawings: Unit drawings shall be provided that indicate assembly, unit dimensions, construction details, clearances and connection details. Computer generated fan curves for each fan shall be submitted with specific design operation point noted. Wiring diagram shall be provided with details for both power and control systems and differentiate between factory installed and field installed wiring.
1.5 DELIVERY, STORAGE, AND HANDLING

A. Unit shall be shipped with doors bolted shut and outside air hood closed to prevent damage during transport and thereafter while in storage awaiting installation.

B. Follow Installation, Operation and Maintenance manual instructions for rigging, moving, and unloading the unit at its final location.

C. Unit shall be stored in a clean, dry place protected from construction traffic in accordance with the Installation, Operation and Maintenance manual.

1.6 WARRANTY

A. Manufacturer shall provide a limited “parts only” warranty for a period of 24 months from the date of original equipment shipment from the factory. Warranty shall cover material and workmanship that prove defective, within the specified warranty period, provided manufacturer’s written instructions for installation, operation and maintenance have been followed. Warranty excludes parts associated with routine maintenance, such as belts and air filters.

1.7 STARTUP REPAIR PROGRAM

A. Manufacturer shall provide startup repair for a period of 12 months from the date of original equipment shipment from the factory. Program shall cover labor for materials and workmanship that prove defective, within the specified warranty period, provided manufacturer’s written instructions for installation, operation and maintenance have been followed. Program excludes labor associated with routine maintenance, such as belt and air filter replacement.

PART 2 - PRODUCTS

2.1 MANUFACTURER

A. Products shall be provided by the following manufacturers:

1. AAON
2. Acceptable substitute manufacturers are Trane, Innovent, and Valent.
3. Substitute equipment must include at a minimum:
   a. R-410A refrigerant
   b. Direct drive supply fans
   c. Double wall cabinet construction
   d. Insulation with a minimum R-value of 13
   e. Stainless steel drain pans
   f. Hinged access doors with lockable handles
   g. Variable capacity compressor with 10-100% capacity
   h. All other provisions of the specifications must be satisfactorily addressed
2.2 ROOFTOP UNITS

A. General Description

1. Packaged rooftop unit shall include compressor, evaporator coil, filters, supply fan, dampers, air-cooled condenser coils, condenser fan, reheat coil, gas heater, exhaust fan, energy recovery wheel, and unit controls.

2. Unit shall be factory assembled and tested including leak testing of the DX coils, pressure testing of the refrigeration circuit, and run testing of the completed unit. Run test report shall be supplied with the unit in the service compartment’s literature pocket.

3. Unit shall have decals and tags to indicate lifting and rigging, service areas and caution areas for safety and to assist service personnel.

4. Unit components shall be labeled, including refrigeration system components and electrical and controls components.

5. Estimated sound power levels (dB) shall be shown on the unit ratings sheet.

6. Installation, Operation and Maintenance manual shall be supplied within the unit.

7. Laminated color-coded wiring diagram shall match factory installed wiring and shall be affixed to the interior of the control compartment’s hinged access door.

8. Unit nameplate shall be provided in two locations on the unit, affixed to the exterior of the unit and affixed to the interior of the control compartment’s hinged access door.

B. Construction

1. All cabinet walls, access doors, and roof shall be fabricated of double wall, impact resistant, rigid polyurethane foam panels.

2. Unit insulation shall have a minimum thermal resistance R-value of 13. Foam insulation shall have a minimum density of 2 pounds/cubic foot and shall be tested in accordance with ASTM D-1929 for a minimum flash ignition temperature of 610°F.

3. Unit construction shall be double wall with G90 galvanized steel on both sides and a thermal break. Double wall construction with a thermal break prevents moisture accumulation on the insulation, provides a cleanable interior, prevents heat transfer through the panel, and prevents exterior condensation on the panel.

4. Unit shall be designed to reduce air leakage and infiltration through the cabinet. Cabinet leakage shall not exceed 1% of total airflow when tested at 3 times the minimum external static pressure provided in AHRI Standard 210/240. Panel deflection shall not exceed L/240 ratio at 125% of design static pressure, at a maximum 8 inches of positive or negative static pressure, to reduce air leakage. Deflection shall be measured at the midpoint of the panel height and width. Continuous sealing shall be included between panels and between access doors and openings to reduce air leakage. Piping and electrical conduit through cabinet panels shall include sealing to reduce air leakage.

5. Roof of the air tunnel shall be sloped to provide complete drainage. Cabinet shall have rain break overhangs above access doors.

6. Access to filters, dampers, cooling coil, reheat coil, heater, exhaust fan, energy recovery wheel, compressor, and electrical and controls components shall be through hinged access doors with quarter turn, lockable handles. Full length stainless steel piano hinges shall be included on the doors.

7. Exterior paint finish shall be capable of withstanding at least 2,500 hours, with no visible corrosive effects, when tested in a salt spray and fog atmosphere in accordance with ASTM B 117-95 test procedure.
8. Units shall include double sloped 304 stainless steel drain pans.
9. Unit shall be provided with through the base vertical discharge and return air openings. All openings through the unit shall have upturned flanges of at least 1/2 inch around the opening.
10. Unit shall include lifting lugs on the top of the unit.

C. Electrical

1. Unit shall be provided with factory installed and factory wired, non-fused disconnect switch.
2. Unit shall be provided with a factory installed and factory wired 115V, 13 amp GFI outlet disconnect switch in the unit control panel.
3. Unit shall be provided with phase and brown out protection which shuts down all motors in the unit if the electrical phases are more than 10% out of balance on voltage, the voltage is more than 10% under design voltage or on phase reversal.

D. Supply Fans

1. Unit shall include direct drive, unhoused, backward curved, plenum supply fans.
2. Blowers and motors shall be dynamically balanced and mounted on rubber isolators.
3. Motor shall be inverter rated efficiency ODP with ball bearings rated for 200,000 hours service with external lubrication points.
4. Variable frequency drive shall be factory wired and mounted in the unit. Fan motor shall be inverter rated efficiency.

E. Exhaust Fans

1. Exhaust dampers shall be sized for 100% relief.
2. Fans and motors shall be dynamically balanced.
3. Access to exhaust fans shall be through double wall, hinged access doors with quarter turn lockable handles.
4. Unit shall include belt driven, unhoused, backward curved, plenum exhaust fans.
5. Motors shall be premium efficiency ODP with ball bearings rated for 200,000 hours service with external lubrication points.
6. Variable frequency drives shall be factory wired and mounted in the unit. Fan motors shall be premium efficiency.

F. Cooling Coils

1. Evaporator Coils
   a. Coils shall be designed for use with R-410A refrigerant and constructed of copper tubes with aluminum fins mechanically bonded to the tubes and aluminum end casings. Fin design shall be sine wave rippled.
   b. Coil shall be standard capacity
   c. Coils shall be helium hydrogen or helium leak tested.
   d. Coils shall be furnished with factory installed thermostatic expansion valves.

G. Refrigeration System

1. Unit shall be factory charged with R-410A refrigerant.
2. Compressors shall be scroll type with thermal overload protection and carry a 5 year non-prorated warranty, from the date of original equipment shipment from the factory.

3. Compressors shall be mounted in an isolated service compartment which can be accessed without affecting unit operation. Lockable hinged compressor access doors shall be fabricated of double wall, rigid polyurethane foam injected panels to prevent the transmission of noise outside the cabinet.

4. Compressors shall be isolated from the base pan with the compressor manufacturer’s recommended rubber vibration isolators, to reduce any transmission of noise from the compressors into the building area.

5. Each refrigeration circuit shall be equipped with thermostatic expansion valve type refrigerant flow control.

6. Each refrigeration circuit shall be equipped with automatic reset low pressure and manual reset high pressure refrigerant safety controls, Schrader type service fittings on both the high pressure and low pressure sides and a factory installed replaceable core liquid line filter driers.

7. Unit shall include a variable capacity scroll compressor on the refrigeration circuit which shall be capable of modulation from 10-100% of its capacity.

8. Refrigeration circuit shall be provided with hot gas reheat coil, modulating valves, electronic controller, supply air temperature sensor and a control signal terminal which allow the unit to have a dehumidification mode of operation, which includes supply air temperature control to prevent supply air temperature swings and overcooling of the space.

9. Refrigeration circuit shall be equipped with a liquid line sight glass.

H. Condensers

1. Air-Cooled Condenser
   a. Condenser fans shall be a vertical discharge, axial flow, direct drive fans.
   b. Coils shall be designed for use with R-410A refrigerant.
   c. Condenser coils shall be multi-pass and fabricated from aluminum microchannel tubes.
   d. Coils shall be designed for a minimum of 10°F of refrigerant sub-cooling.
   e. Coils shall be hydrogen or helium leak tested.
   f. Condenser fans shall be high efficiency electrically commutated motor driven with factory installed head pressure control module. Condenser airflow shall continuously modulate based on head pressure and cooling operation shall be allowed down to 35°F with adjustable compressor lockout.

I. Electric Heat

1. Provide an open wire electric heating coil with thermal high limit cut-outs and over current protection. Units with electric heat shall have a single point power connection.

J. Filters

1. Unit shall include 2 inch thick, pleated panel filters with an ASHRAE efficiency of 30% and MERV rating of 8, upstream of the cooling coil.
K. Outside Air/Economizer

1. Unit shall include 0-100% economizer consisting of a motor operated outside air damper and return air damper assembly constructed of extruded aluminum, hollow core, airfoil blades with rubber edge seals and aluminum end seals. Damper blades shall be gear driven and designed to have no more than 15 CFM of leakage per sq. ft. of damper area when subjected to 2 inches w.g. air pressure differential across the damper. Unit shall include outside air opening bird screen, outside air hood with rain lip and barometric relief dampers.

2. Damper assembly shall be controlled by spring return enthalpy activated fully modulating actuator.

L. Energy Recovery

1. Unit shall contain a factory installed and tested energy recovery wheel. The energy recovery wheel shall be mounted in an insulated cassette frame containing the wheel drive motor, drive belt, wheel seals and bearings. Rigid frame shall be removable from the cabinet.

2. Wheel shall be wound continuously with one flat and one structured layer in an ideal parallel plate geometry providing laminar flow and minimum pressure drop-to-efficiency ratios. The layers shall be effectively captured in stainless steel wheel frames or aluminum and stainless steel segment frames that provide a rigid and self-supporting matrix.

3. Wheel frame construction shall be a welded hub, spoke and rim assembly of stainless, plated and/or coated steel and shall be self-supporting without matrix segments in place. Wheel bearings shall be selected to provide an L-10 life in excess of 400,000 hours. Rim shall be continuous rolled stainless steel.

4. All diameter and perimeter seals shall be provided as part of the cassette assembly and shall be factory set. Drive belts of stretch urethane shall be provided for wheel rim drive without the need for external tensioners or adjustment.

5. The energy recovery cassette shall be an Underwriters Laboratories Recognized Component for electrical and fire safety. The wheel drive motor shall be an Underwriters Laboratory Recognized Component and shall be mounted in the cassette frame and supplied with a service connector or junction box. Thermal performance shall be certified by the manufacturer in accordance with ASHRAE Standard 84, Method of Testing Air-to-Air Heat Exchangers and AHRI Standard 1060, Rating Air-to-Air Energy Recovery Ventilation Equipment. Cassettes shall be listed in the AHRI Certified Products.

6. Energy recovery wheel cassette shall carry a 5 year non-prorated warranty, from the date of original equipment shipment from the factory. The first 12 months from the date of equipment startup, or 18 months from the date of original equipment shipment from the factory, whichever is less, shall be covered under the standard AAON limited parts warranty. The remaining period of the warranty shall be covered by AirXchange. The 5 year warranty applies to all parts and components of the cassette, with the exception of the motor, which shall carry an 18 month warranty. Warranty shall cover material and workmanship that prove defective, within the specified warranty period, provided the AirXchange written instructions for installation, operation and maintenance have been followed. Warranty excludes parts associated with routine maintenance, such as belts. Refer to the AirXchange Energy Recovery Cassette Limited Warranty Certificate.

7. Unit shall include 2 inch thick, pleated panel outside air and exhaust air filters with an ASHRAE efficiency of 30% and MERV rating of 8, upstream of the wheels.
8. Hinged service access door shall allow access to the wheel.
9. Total energy recovery wheel shall be coated with silica gel desiccant permanently bonded by a process without the use of binders or adhesives, which may degrade desiccant performance. The substrate shall be lightweight polymer and shall not degrade nor require additional coatings for application in marine or coastal environments. Coated wheel shall be washable with detergent or alkaline coil cleaner and water. Desiccant shall not dissolve nor deliquesce in the presence of water or high humidity.

M. Controls

1. Factory Installed and Factory Provided Controller
   a. Unit controller shall be capable of controlling all features and options of the unit. Controller shall be factory installed in the unit controls compartment and factory tested.
   b. Controller shall be capable of stand-alone operation with unit configuration, set point adjustment, sensor status viewing, unit alarm viewing, and occupancy scheduling available without dependence on a building management system.
   c. Controller shall have an onboard clock and calendar functions that allow for occupancy scheduling.
   d. Controller shall include non-volatile memory to retain all programmed values without the use of a battery, in the event of a power failure.
   e. Constant Volume Controller: The ERU shall be provided with a programmable controller designed for space temperature and humidity control. Controller shall modulate the capacity of the compressor, modulate the NG heat, modulate the hot gas reheat coil and vary the speed of the condenser fans to maintain the set point conditions.
   f. Contractor shall install and wire one wall mounted humidity sensor and one wall mounted temperature sensor with adjustment capabilities of +/- 2F. Contractor shall install and wire unit supply air temperature sensor per the manufacturer’s requirements.

2. Unit shall modulate cooling with constant airflow to meet space temperature cooling loads.
3. With modulating hot gas reheat, unit shall modulate cooling and hot gas reheat as efficiently as possible, to meet space humidity loads and prevent supply air temperature swings and overcooling of the space.
4. Unit shall modulate heating with constant airflow to meet space temperature heating loads. Modulating heating capacity shall modulate based on supply air temperature.
   a. Unit configuration, set point adjustment, sensor status viewing, unit alarm viewing, and occupancy scheduling shall be accomplished with connection to interface module with LCD screen and input keypad.

2.3 CURBS

A. Curbs shall to be fully gasketed between the curb top and unit bottom with the curb providing full perimeter support, cross structure support and air seal for the unit. Curb gasket shall be furnished within the control compartment of the rooftop unit to be mounted on the curb immediately before mounting of the rooftop unit.
B. Curb with duct support rails shall be factory furnished.

PART 3 - EXECUTION

3.1 INSTALLATION, OPERATION AND MAINTENANCE

A. Installation, Operation and Maintenance manual shall be supplied with the unit.

B. Installing contractor shall install unit, including field installed components, in accordance with Installation, Operation and Maintenance manual instructions.

C. Start up and maintenance requirements shall be complied with to ensure safe and correct operation of the unit.

END OF SECTION
PART 1 - GENERAL
1.1 DESCRIPTION

A. Furnish and install a self-compensating ventilation canopy over the cooking battery complete with makeup and exhaust fans with curbs, grease filters, dry chemical fire suppression system, vapor-proof lights and controls.

PART 2 - PRODUCTS

2.1 KITCHEN HOOD VENTILATION AND EXHAUST SYSTEM

A. Description: Hood over food cooking equipment shall provide for both air supply and air exhaust. Supply air provided through blower with filters directly from outside. Exhaust air pulled through “grease” extractor filters and discharged vertically above the roof. Canopy shall be constructed with a totally welded inner exhaust canopy and a complete outer canopy providing an air plenum between the exhaust and supply canopies on the top and front. Canopy ends shall be double thickness 18-gauge material as specified. Canopy shall be of the short circuit design. Refer to the Drawings for model, size and capacities.

B. Features of Range Hood:

1. Stainless steel construction with matching soffit above to ceiling. Outside surface shall be finished white epoxy enamel.
2. “Grease” extractor filters shall be stainless steel, UL Labeled, 20" x 20" x 2" size, self-draining.
3. Removable grease gutters under filters, pitched to drain to a removable metal collection container.
4. Makeup air slots shall be adjustable. Hood shall have been tested and rated by Underwriters Laboratories Inc. for a proven exhaust rate of 250 cfm L/F over high heat (600 degrees F+) cooking equipment with a supply air ratio of 84%, as listed by UL for the high heat test.
5. Built in vapor proof hood interior lights, one per each 3 feet of length, pre-wired to switch.
6. Pre-wired control panels with stainless steel exposed surface containing operating pilot lights and switches.
7. Hood size to completely cover the cooking equipment plus an overhang of 12" minimum on all sides.
8. Hood to be UL classified.

C. Features of Duct Package:

1. Exhaust duct shall be all welded construction per NFPA 96.
2. Exhaust and supply ducts shall be of the concentric arrangement and UL Labeled number MH10644 so that the exterior duct can be installed to within 1” of combustible materials. Duct to include slip joint connections as approved by UL for vertical duct, with horizontal duct to include flanges for field welding.
3. Parallel duct arrangement is acceptable providing the Contractor satisfies the clearance requirements of NFPA 96 and the local fire marshal.
D. Features of Roof-Mounted Assembly:

1. Supply air fan package constructed of aluminized steel including intake section with air filters and birdscreen, support legs and factory enamel finish.
2. Top discharge exhaust fan with plug in connection for master electric panel, furnished for field installation of factory furnished economizer section. No birdscreens or backdraft dampers. The fan shall be UL Labeled for grease contaminated air. Provide low silhouette curb as drawn.
3. Master electric pre-wired control panel, factory mounted and wired with main power source connection, control circuit terminal strip, magnetic motor contactors, manual motor overload switch, contactors, relays, transformers, circuit breakers, fuses and fused disconnect.
4. Factory wiring in conduit conforming to NFPA Standard 70 and designed to withstand effects of heat, vapor and grease on the equipment. Wiring shall include low voltage (24 volt) control wiring in conduit to opening in top of canopy, connecting wiring harness and conduit to master electric control panel.
5. A complete kitchen hood fire extinguishing system shall be provided under this item.
6. Approval: The “Seal of Approval” of the NATIONAL SANITATION FOUNDATION TESTING LABORATORY (NFS) shall appear on the Ventilation System.

2.2 EXHAUST CANOPY FIRE PROTECTION SYSTEM

A. The fire suppression protection system should be of the stored pressure, wet chemical pre-engineered fixed nozzle type manufactured by Wells Fargo Pyro Technologies, Inc. A carbon dioxide cartridge is designed in compliance with Military Specification "MIL-C-601G," and shall be used as the pneumatic releasing device for the system. The cartridge shall be an integral part of the control head assembly. The wet chemical storage cylinder shall be D.O.T. rated for stored pressure of 175 psig, and a pressure gauge shall be provided on the cylinder valve for visual inspection. The system shall be capable of automatic and manual actuation. Automatic actuation shall be provided by an appropriate number of thermal detectors mounted in series on a stainless steel wire input line to the control head. Manual actuation shall be provided by turning a handle on the primary head and/or by an optional remote pull station with a dedicated stainless steel input line to the control head.

B. The system shall have been tested to the UL Standard for Fire Extinguishing Systems for Protection of Restaurant Cooking Areas, UL 300, and listed by Underwriters Laboratories Inc. It shall be installed in accordance with the National Fire Protection Association Standard No. 17A Wet Chemical Extinguisher Systems, and No. 96 Standard for the Installation of Equipment for the Removal of Smoke and Grease Laden Vapors from Commercial Cooking Equipment, and comply with all local and/or state codes and standards.

C. Provide pressure activated electric shutoff switch and remote manually operated shutoff switch to all gas and electric cooking equipment located under hood and to exhaust and makeup fans shutoff switch.
D. All piping shall be schedule 40 hot-dipped galvanized steel. Fittings shall be banded pattern, extra heavy galvanized malleable iron threaded with a 2,000 psi WOG rating.

2.3 SUPPLY AND EXHAUST DUCT

A. Furnish and install supply and exhaust ductwork in accordance with the latest edition of NFPA 96 and all applicable local codes.

B. Exhaust ductwork shall be constructed of black steel minimum of 16-gauge thickness. All seams, joints, and penetrations shall have a continuous external weld except where the exhaust duct is connected to the exhaust canopy collar. Connection to the exhaust canopy collar shall be constructed in accordance with NFPA 96.

2.4 ROOFTOP MAKEUP AIR FAN

A. Provide air supply utility set of the single inlet, single width type. Fan housing shall be constructed of heavy gauge galvanized steel with weatherproof coating. Fan shall be provided with weather housing.

B. Fan wheel shall be aluminum, backwards inclined non-overloading. Fan shall be complete with adjustable belt drives, motor and disconnect switch.

C. Provide fan with filter hood for use with 2" thick cleanable filters complete with hood support frame, roof curb adapter for use in the downblast arrangement, backdraft damper and birdscreen.

2.5 ROOFTOP CENTRIFUGAL UPBLAST EXHAUST

A. Provide UL Listed upblast centrifugal fan of aluminum construction complete with non-sparking centrifugal fan wheel.

B. Fan shall come complete with motor and adjustable belt drive, disconnect switch, birdscreen, grease trough, and hinged base (for cleaning).

C. Fan and installation shall comply with NFPA 96.

D. Motor, bearings, and drive shall be isolated from exhaust air. Motor shall be cooled by clean outside air.

PART 3 - EXECUTION - Not Used

END OF SECTION
PART 1 - GENERAL

1.1 GENERAL REQUIREMENTS

A. General Conditions: Refer to the General Conditions, the Supplementary General Conditions and the Special Conditions, all provisions of which apply to work under this section as if written in full herein.

B. The scope of work described in these Specifications and/or indicated on the Drawings shall include (except where otherwise noted) the furnishing of all materials, equipment, appurtenances, accessories, connections, labor, etc. required and/or necessary to completely install, clean, inspect, adjust, test, balance and leave in safe and proper operating condition all systems. All work shall be accomplished by workmen skilled in the various trades involved.

C. The Drawings and Specifications are complementary to each other and what is called for by one shall be as binding as if called for by both. If a discrepancy exists between the Drawing and Specifications, the higher costs shall be included, and the Engineer shall be notified of the discrepancy.

D. All work performed under this specification shall be accomplished in accordance with the requirements and provisions of Section 15000 - HVAC General.

1.2 STANDARDS

A. All Plumbing systems shall conform to all ordinances and regulations of the City, County, State and/or other authorities having jurisdiction in accordance with the requirements of the following codes, standards and design guides.

5. Americans with Disabilities Act (ADA)
6. ANSI/NSF 61, NSF 372, and NSF 61-G compliance is required for all components of the domestic potable water system.
7. American Society of Plumbing Engineers (ASPE) Data Books
8. National Fire Protection Association (NFPA) Standards:
   a. NFPA 54 - National Fuel Gas Code
9. Plumbing Drainage Institute (PDI)
10. Underwriters Laboratories Inc. (UL)
11. National Sanitation Foundation (NSF)
12. Local and State Fire Marshal requirements
13. Local Building and Inspection Department requirements
14. Local Health Department requirements
B. If code or other requirements exceed the provisions shown on the Contract Documents, the Engineer shall be notified in writing. Where requirements of the Contract Documents exceed code requirements, work shall be furnished and installed in accordance with the Contract Documents. Any work done contrary to these requirements shall be removed and replaced at the Contractor's expense.

1.3 PERMITS

A. The Contractor shall obtain all permits and inspections required for the installation of this work and pay all charges incident thereto. He shall deliver to the Architect all certificates of said inspection.

1.4 WORK INCLUDED

A. Systems

1. The Plumbing Systems installed and work performed under this Division of the Specifications shall include, but not necessarily be limited to, the following as noted below. The connection point for all systems from the site utilities shall be as 5'-0" from the exterior of the building unless specifically otherwise noted.

   a. Domestic cold, hot and hot water recirculation systems
   b. Sanitary, drainage, waste and vent systems
   c. Natural gas/propane gas system

1.5 DRAWINGS

A. The Drawings are diagrammatic and do not necessarily depict exact conditions. The indicated locations of equipment, ductwork, piping, etc. are approximate only. The Drawings are schematic in nature and are not to be scaled. Scales are shown for reference and approximation only. Refer to the architectural drawings for dimensional data of building components.

B. The locations, arrangement and extent of equipment, devices, and other appurtenances related to the installation of work shown on the Drawings are approximate. The Contractor shall not scale drawings, but shall refer to the architectural drawings for exact dimensions of building components. Should a conflict exist between the architectural and engineering drawings regarding dimensions and scale, the Contractor shall notify the Architect of the discrepancy for resolution.

C. Materials, equipment or labor not indicated but which can be reasonably inferred to be necessary for a complete installation shall be provided. Drawings and Specifications do not undertake to indicate every item of material, equipment, or labor required to produce a complete and properly operating installation.

1.6 OPERATION AND MAINTENANCE MANUALS

A. The Contractor shall prepare a minimum of two (2) instruction manuals, one of which shall be submitted to the Architect for the Engineer's review, describing installation, operation and maintenance of all Plumbing equipment. Manuals shall include copies of control schematics, sequences of operations, indicate the function and operations of all components, as well as the Contractor's name, address, and telephone number. Manuals shall also contain one copy of all manufacturers' drawings, pamphlets, data,
parts lists and instructions manual for each piece of equipment. Upon approval, one copy shall be delivered to the Owner; one copy shall be kept by the Contractor. The pamphlets and drawings are to be neatly bound in a 3-ring binder(s).

B. The Contractor shall give detailed instructions for a period of not less than two (2) days to the responsible personnel designated by the Owner in the operation and maintenance of all equipment furnished under this Contract. A letter containing the name of the person or persons to whom the instructions were given and the dates of instruction period shall be submitted to the Engineer in the as-built submittal.

C. Prior to final acceptance by the Owner, the Contractor shall submit a complete as-built drawing submittal for the Engineer’s review, three (3) sets of operating and maintenance manuals, spare parts lists, drawings, wiring diagrams, troubleshooting data, manufacturer’s bulletins, and other pertinent data on all equipment furnished under this Contract. Each set shall be enclosed in a suitable hard cover binder.

D. A complete set of reproducible as-built drawings shall be provided indicating the location of all piping dimensionally located from a minimum of two column lines or major building structures. Drawings shall be a minimum of 1/8" scale.

E. Provide name, address and telephone numbers of the manufacturer’s representative and service company for each piece of equipment installed in the as-built submittal package.

F. Provide all loose keys for supply valves, wall hydrants and hose bibbs installed.

G. Provide a full repair kit set (total relief valve kit, first check and second check kits) for each reduced pressure backflow preventer installed.

1.7 AS-BUILT DRAWINGS

A. The Contractor shall maintain a record set of drawings indicating all changes in the work from that shown in the Contract Documents. Prior to final acceptance by the Owner, the Contractor shall assemble the complete set of as-built drawings that accurately reflects all changes to indicate actual final construction. All concealed piping shall be dimensionally located from at least two (2) column lines or major building structure elements. Drawings shall be a minimum of 1/8" scale.

B. The original set of “as-built” drawings shall be scanned and transmitted to the Architect in both full size mylar and CD format.

1.8 EQUIPMENT, MATERIAL BID BASIS

A. Manufacturers’ names, model numbers, etc. as specified on the Drawings and herein are for the purpose of describing type, capacity, function and quality of equipment and materials required.

B. Unless “approved equal” is specifically stated, bids shall be based on equipment named in Specifications or on Drawings as “base” products. Proposed alternate equipment and materials may be submitted along with the “base” products, provided deductive pricing is included with the alternate.

C. Alternate “approved equal” items listed shall conform to specified base items and shall be substantially equal in quality, size, weight, construction, capacities and performance. The
alternate equipment and materials shall be submitted as full equivalent to the equipment and materials specified, with sufficient supportive documentation and technical literature to demonstrate quality, performance, and workmanship without doubt or question. The Engineer shall consider the use of the alternate equipment based on the supportive documentation and other information available to him, and shall approve or disapprove any alternates. The decision of the Engineer shall in all cases be final.

D. The Contractor shall coordinate the installation of all plumbing equipment proposed for use in this project with all building trades (architectural, structural, mechanical and electrical). Coordination shall be accomplished prior to, and shall be reflected in, the submittal of shop drawings for approval. Any modifications or revisions required by other trades as a result of the use of equipment other than the basis of design shall be made at no additional cost. When substitution of equipment is made, the Contractor shall be responsible for the costs of any item and engineering and construction revisions necessary in his or any other contract or trade that may be required to satisfy plans and specifications.

1.9 START-UP-SERVICE

A. The service of a factory-trained representative shall be provided on the jobsite for a minimum of one (1) day to provide the manufacturer's certification and start-up of all major equipment and systems including water heaters, etc. A formal report is to be issued indicating any revisions required for certification of the assembly by the manufacturer. Instruction and training of the operator's personnel shall be provided following certification of the assembly.

1.10 SUBMITTALS

A. The Contractor shall prepare, submit, and obtain Engineer's review of manufacturers' submittals on the following equipment and systems prior to ordering, purchasing, or installation of any equipment or materials. All required submittals shall be transmitted simultaneously in hard ring binders with the associated specification section and the item submitted clearly identified. Partial submittals will be returned without review.

1. Plumbing fixtures, faucets and trim
2. Water heaters and storage tanks
3. Insulation
4. Floor drains and drainage accessories
5. Hydrants and hose bibbs
6. Mixing valves
7. Hot water return pumps
8. Backflow preventers
9. Pipe and fittings
10. Grooved joint couplings
11. Valves
12. Pipe supports
13. Piping accessories
14. Pipe labels and valve tags

B. All approvals required by any code or enforcement authority, insurance underwriter, etc. shall be obtained prior to equipment being submitted to the Engineer.
C. Quality Assurance/Control Submittals: Submit the following:

1. Test Reports: Upon request, submit test reports from recognized testing laboratories.
2. Certificates: Submit the following:
   a. Manufacturer’s certificate that products comply with specified requirements.
   b. Certificate indicating that the installer is authorized to install the manufacturer’s products

D. Review of submittals by the Engineer does not relieve the Contractor from the responsibility for complying with all requirements of the Contract Documents. Furthermore, it shall be the responsibility of the Contractor to coordinate the requirements of all approved equipment with other trades and disciplines such as roof openings, wall openings, electrical characteristics, etc.

E. All submittals shall be identified by the equipment mark or tag identification numbers shown on the Contract Drawings. Each individual submittal item shall be marked to show which specification section pertains to the item.

F. Submittals shall clearly indicate selection of model numbers, sizes, dimensions, electrical characteristics, etc. of the proposed equipment. Any proposed deviations from specified equipment shall be clearly indicated on the submittal.

G. Included with submittals of plumbing equipment requiring electrical connections shall be a written statement confirming coordination of voltage requirements, bearing the names and signatures of the plumbing and electrical contractors. A photocopied reproduction of the below statement is acceptable.

VOLTAGE COORDINATION STATEMENT

This statement is to confirm that the voltages of the equipment provided under this specification have been coordinated with the Electrical Drawings, as well as with the electrical contractor.

Plumbing Contractor:

Project Manager Name:
Project Manager Signature/Date:

Electrical Contractor:

Project Manager Name:
Project Manager Signature/Date:

1.11 COORDINATION OF TRADES

A. The Contractor shall give full cooperation to other trades, and shall furnish all information necessary to permit the work of all trades to be installed satisfactorily and with least possible interference or delay.

B. Piping and other plumbing equipment shall not be installed without first coordinating the installation of same with other trades. The Contractor, at his own expense, shall relocate...
all uncoordinated piping and other plumbing equipment installed should they interfere
with the proper installation and mounting of electrical, HVAC equipment, ceilings and
other architectural or structural finishes.

C. The Contractor shall coordinate the elevations of all piping and equipment above ceilings
and in exposed areas with the work of all other disciplines prior to installation.

D. In areas where more than one trade is required to use common openings in beams,
joists, chases, shafts and sleeves for the passage of conduits, raceways, piping,
ductwork and other materials, the Contractor must coordinate the positions of all piping
and equipment to be furnished under this section so that all items including the materials
and equipment of other trades may be accommodated within the space available.

E. The Contractor shall confirm that work installed under this section does not interfere with
the clearances required for finished columns, pilasters, partitions, walls or other
architectural or structural elements as shown on the Contract Documents.

F. Work that is installed under this Contract which interferes with the architectural design or
building structure shall be removed and relocated as required at no additional cost to the
Contract.

G. All offsets, fittings, valves, devices and accessories which may be required are to be
provided under this Contract. The Contractor shall examine the entire set of Contract
Documents and carefully investigate the structural and finish conditions affecting all his
work and shall arrange such work accordingly for the complete satisfactory operation of
all systems, providing such fittings, traps, valves, devices and accessories as may be
required to meet such conditions.

1.12 WARRANTY

A. All equipment furnished and installed under this Contract shall be provided with the
manufacturer’s standard warranty unless otherwise noted.

B. The Contractor shall make good all defects in material, equipment, or workmanship
disclosed within a period of one (1) year from date of building acceptance by the Owner.
The phrase “make good” shall mean to furnish promptly, without charge, all work
necessary to remedy the defects to the satisfaction of the Engineer.

PART 2 - PRODUCTS

2.1 GENERAL REQUIREMENTS

A. All equipment, materials, accessories, etc. used shall be new and of current production
unless specified otherwise. Equipment not specified in the Contract Documents shall be
suitable for the intended use and shall be subject to approval by the Engineer.

B. All equipment, products and materials shall be free of defects and shall be constructed to
operate in a safe manner without excessive noise, vibration, leakage, or wear.

C. All equipment shall bear the inspection label of Underwriters Laboratories Inc.
D. All equipment and material for similar applications or systems shall be provided from the same manufacturer unless noted otherwise.

E. All grooved joint couplings, fittings, valves, and specialties shall be the products of a single manufacturer. Grooving tools shall be of the same manufacturer as the grooved components.

F. All castings used for coupling housings, fittings, and valve bodies shall be date stamped for quality assurance and traceability.

G. Cast iron soil pipe and fittings shall bear the collective trademark of the Cast Iron Soil Pipe Institute.

2.2 ELECTRICAL WORK

A. Except as otherwise specified or noted, electrical equipment used for plumbing systems shall be as specified herein.

B. Motor controls, system controls, starters, disconnects, pilot lights, push buttons, etc. shall be furnished by the Contractor compatible with the apparatus that it operates. Electrical equipment shall be wired for the voltage, as shown on the Electrical Drawings.

C. The Contractor shall be responsible for coordinating and furnishing equipment of voltage shown on the electrical documents.

D. Electric motors shall be high efficiency, open drip-proof type unless otherwise specified. Motors shall be standard NEMA continuous duty type and shall bear the UL Label. Motors shall be selected with a minimum of 15% safety factor greater than the fan brake/horsepower (e.g. 4.75BHP would require a nominal 7-1/2 HP motor). The motor service factor shall not be used as part of the safety factor. All motors shall have thermal overload protection. Motors shall meet Table MG-1-12C of EPACT 1992.

E. Motors controlled by a variable frequency drive (VFD) shall be inverter duty rated and fully compatible with the VFD provided.

F. Starters for motors 1/3 HP and smaller shall be manual type, and for 1/2 HP and larger, shall be magnetic type. Starters shall be minimum size 0, combination type (with disconnect and lockable handle) with molded case circuit breaker. Starters for motors with remote or automatic control shall be magnetic. Relays, interlocks and auxiliary contacts shall be provided as specified and required.

G. Magnetic motor starters shall be across-the-line, full voltage, non-reversing type unless otherwise indicated on the Drawings or specified herein.

H. Motor controls shall be either “Hand-Off-Auto” switches or “On-Off” push buttons with one indicating light. “Hand-Off-Auto” switches shall be provided for automatically controlled apparatus.

I. Motor starters that are not an integral part of equipment shall be installed in conformance with Division 16 - Electrical Requirements.

J. All “loose” disconnects and starters shall be installed by Division 16.
K. Power wiring to disconnects, starters, and equipment shall be provided and installed by Division 16. All equipment requiring electrical power shall be provided with disconnect switches at each piece of equipment. Coordinate switch type (fused or non-fused) with equipment characteristics, manufacturer’s recommendations and Electrical Drawings.

L. The Contractor shall provide all system controls, control and interlock wiring 120 volts and less in conduits in accordance with materials and installation requirements of Electrical Section. All starters shall be labeled on face of starter.

M. All starters for 3-phase equipment shall have overload devices in all three (3) phases.

N. Wiring diagrams shall be furnished by the Contractor.

O. Acceptable manufacturers shall be General Electric, Square D, Eaton, Siemens and Allen Bradley.

2.3 PIPING SYSTEMS

A. General

1. The various piping systems are classified as follows, and materials of construction shall be as specified unless otherwise noted on the Drawings.

2. Piping, valves and equipment used in similar applications shall be provided from the same manufacturer unless noted otherwise.

B. Domestic Cold Water System, Underground, 3 Inches and Larger, Suitable for Working Pressure of 125 psig to 5'-0" Outside Building

1. Piping Systems

   a. Basis of Design

      1) Ductile iron thickness Class 51 for 3 inch and 4 inch size thickness, Class 50 for 6 inches and larger, ANSI A21.51, ASTM A746 with bituminous coating outside and cement mortar lining inside. Ductile iron mechanical or push-on joints and fittings ANSI/AWWA C110/A21.10.

   b. Deductive Alternates

      1) Mains where pressure is no greater than 100 psi: Polyvinyl Chloride (PVC), 160 psi water piping, ASTM D2241, SDR26 with mechanical or push-on joints with neoprene “O” rings, ASTM D3139.

      2) Mains where pressure is greater than 100 psi: Polyvinyl chloride (PVC), 200 psi water piping, AWWA C900, 200 psi, with mechanical or push-on joints with neoprene “O” rings, ASTM D3139.

2. All valves, fittings, and changes in direction or elevation shall have joints restrained in accordance with NFPA-24.

3. Trenching Conditions: Class B1 bedding with 4" minimum thickness of clean granular fill. Recesses shall be provided at all pipe barrels to ensure no loads are transmitted at the joint connections.
C. Domestic Water System Branch Piping, Underground, 2 Inches and Smaller, Suitable for a Working Pressure of 125 psig

1. Piping Systems
   a. Copper Type K, soft annealed, conforming to Federal Specification WWT-799. Joints and fittings are not permitted below floor slabs with copper Type K soft annealed pipe.

D. Domestic Cold Water and Hot Water Systems Above Ground

1. Piping Systems
   a. Basis of Design
      1) Polypropylene piping, Aquatherm Green pipe SDR 7.4 for cold & hot water systems 3" and smaller, or SDR 11 for hot water systems 4" and larger and all cold water systems based on the required minimum pressure rating and use temperature, see chart below. Piping, fittings, and joints to comply with NSF 61-G, NSF 61, and NSF 372. Provide pipe wrap or insulation for piping in all plenum applications that meet the requirements of ASTM E84. When piping will be exposed to UV light for more than 30 days a factory UV protection must be provided per the manufacturer’s recommendations. Fittings/Joints: Shall be aquatherm green pipe electro-fusion welded PP-R joints and fittings, ASTM F2389, NSF 61 certified.

<table>
<thead>
<tr>
<th>Temperature</th>
<th>Pipe Sizes</th>
<th>SDR 7.4 Green Pipe Permissible working pressure (psi)</th>
<th>SDR 11 Green Pipe Permissible working pressure (psi)</th>
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<td>50</td>
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<tr>
<td>180</td>
<td>(All pipe sizes)</td>
<td>100</td>
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2) Type “L” hard drawn copper tubing per ASTM B-88 and Federal Specification WWT-799. Piping, fittings, and joints to comply with NSF 61-G, NSF 61, and NSF 372. Fittings: Solder or brazed joint copper fittings per B16.18 or 16.22. Grooved copper fittings with full flow radius elbows; wrought copper to ASME B16.22 and ASTM B-75, or cast bronze to ASME B16.18 and ASTM B-584, Victaulic CTS system, or Engineer approved equal. Copper pressed fittings with radius elbows, crimped connections and EPDM O-rings, ASTM B-88, 200 psi rating, Ridgid Viega ProPress, ProPress XL or Elkhart Xpress systems. Ductile iron mechanical couplings with bolted connection for
grooved piping, ASTM A-536, housings with offsetting angle-pattern bolt pads, with EPDM-HP copper tube size gaskets, rated working pressure 300 psi, installation-ready for direct stab installation without field disassembly. Basis of Design: Victaulic Style 607H. Joints: Soldered or brazed joints with lead-free brazing filler materials and compatible alloys.

<table>
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<th>Temperature</th>
<th>Pipe Sizes</th>
<th>Type L Drawn Copper Tubing Permissible working pressures using NO LEAD SOLDERED FITTINGS (psi)</th>
<th>Type L Drawn Copper Tubing Permissible working pressures using PRESS FITTINGS (psi)</th>
<th>Type L Drawn Copper Tubing Permissible working pressures using ROLL GROVE FITTINGS (psi)</th>
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<tr>
<td></td>
<td>10&quot;-12&quot;</td>
<td>230</td>
<td>N/A</td>
<td></td>
</tr>
</tbody>
</table>

3) Schedule 10 T304L stainless steel pipe, ASTM A312 (300 psi at 140 degrees F), Schedule 40 T304L stainless steel pipe, ASTM A312 (600 psi at 140 degrees F). Piping, fittings, and joints to comply with NSF 61-G, NSF 61, and NSF 372. Fittings: Schedule 10S/40S rolled groove 304 stainless steel fittings. Joints: Ductile iron or 316 stainless steel rigid grooved couplings, EPDM gasket, 316 stainless steel nuts and bolts. Victaulic Style 89, Anvil Figure 7400 (300 psi for 10S), Victaulic Style 489, Anvil Figure 7401 (600 psi for 40S).

a) Schedule 10S pipe shall be grooved using a Victaulic grooving tool equipped with RX roll sets, specifically designed for stainless steel pipe.

4) For pipe sizes 2" and smaller, the Vic-Press system for Schedule 10S pipe may be used in lieu of soldered copper. The system shall be rated to 500-psi CWP, with grade EPDM gaskets, UL classified in accordance with ANSI/NSF-61 for potable water service.
### Temperature Pipe Sizes

<table>
<thead>
<tr>
<th>Temperature</th>
<th>Pipe Sizes</th>
<th>Stainless Steel Tubing Permissible working pressures using NO LEAD SOLDERED FITTINGS (psi)</th>
<th>Stainless Steel Tubing Permissible working pressures using PRESS FITTINGS (psi)</th>
<th>Stainless Steel Tubing Permissible working pressures using ROLL GROVE FITTINGS (psi)</th>
</tr>
</thead>
<tbody>
<tr>
<td>100</td>
<td>½&quot;-1&quot;</td>
<td>3000</td>
<td>500</td>
<td>300</td>
</tr>
<tr>
<td></td>
<td>1¼&quot;-2&quot;</td>
<td>1460</td>
<td>500</td>
<td>300</td>
</tr>
<tr>
<td></td>
<td>2½&quot;- 4&quot;</td>
<td>725</td>
<td>500</td>
<td>300</td>
</tr>
<tr>
<td></td>
<td>5&quot;-8&quot;</td>
<td>590</td>
<td>N/A</td>
<td>300</td>
</tr>
<tr>
<td></td>
<td>10&quot;-12&quot;</td>
<td>360</td>
<td>N/A</td>
<td></td>
</tr>
<tr>
<td>200</td>
<td>½&quot;-1&quot;</td>
<td>2550</td>
<td>500</td>
<td>300</td>
</tr>
<tr>
<td></td>
<td>1¼&quot;-2&quot;</td>
<td>1241</td>
<td>500</td>
<td>300</td>
</tr>
<tr>
<td></td>
<td>2½&quot;- 4&quot;</td>
<td>616</td>
<td>500</td>
<td>300</td>
</tr>
<tr>
<td></td>
<td>5&quot;-8&quot;</td>
<td>500</td>
<td>N/A</td>
<td>300</td>
</tr>
<tr>
<td></td>
<td>10&quot;-12&quot;</td>
<td>300</td>
<td>N/A</td>
<td></td>
</tr>
</tbody>
</table>

**b. Deductive Alternates**


### Temperature

<table>
<thead>
<tr>
<th>Temperature</th>
<th>SDR 11 FlowGuard Gold CPVC Permissible working pressure (psi)</th>
<th>Schedule 80 Corzan (for Pipe Sizes greater 2&quot;) Permissible working pressure (psi)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pipe Sizes</td>
<td>½&quot;-2&quot; (max size)</td>
<td>2½&quot;</td>
</tr>
<tr>
<td>73-80</td>
<td>400</td>
<td>420</td>
</tr>
<tr>
<td>100</td>
<td>325</td>
<td>344</td>
</tr>
<tr>
<td>120</td>
<td>260</td>
<td>273</td>
</tr>
<tr>
<td>140</td>
<td>200</td>
<td>210</td>
</tr>
<tr>
<td>160</td>
<td>160</td>
<td>168</td>
</tr>
<tr>
<td>180</td>
<td>100 (max. temp)</td>
<td>105</td>
</tr>
<tr>
<td>200</td>
<td>84 (max. temp)</td>
<td>74</td>
</tr>
</tbody>
</table>

   a) Acceptable PEX manufacturers/systems:
      (1) Uponor Wirsbro Aquapex tubing with ProPEX fittings
      (2) Rehau Raupex tubing with EVERLOC fittings

   b) All PEX tubing and fittings shall be from the same manufacturer.

   c) Galvanized pipe and nipples are not acceptable for any portions of the domestic water system.

<table>
<thead>
<tr>
<th>Temperature</th>
<th>Pipe Sizes</th>
<th>SDR 9 PEX piping Permissible working pressure (psi)</th>
</tr>
</thead>
<tbody>
<tr>
<td>73-80</td>
<td>3/8&quot;-4&quot;</td>
<td>160</td>
</tr>
<tr>
<td>120</td>
<td>3/8&quot;-4&quot;</td>
<td>130</td>
</tr>
<tr>
<td>180</td>
<td>3/8&quot;-4&quot;</td>
<td>100</td>
</tr>
<tr>
<td>200 (max temp)</td>
<td>3/8&quot;-4&quot;</td>
<td>80</td>
</tr>
</tbody>
</table>

E. Sanitary, Waste and Vent and Storm Drain Systems, Below Ground to 5'-0" Outside Building

1. Piping Systems

   a. Basis of Design


      2) No-hub cast iron soil pipe per CISPI 301 and ASTM A888. Fittings: No hub cast iron fittings per CISPI 301 and ASTM A888. Joints: Cast iron mechanical couplings with neoprene gaskets and stainless steel nuts and bolts. Heavy duty type 304 stainless steel shielded couplings, ASTM C1540. Acceptable manufacturers: Husky SD 4000 or Clamp-All 125.

   b. Deductive Alternates

      1) Schedule 40 DWV PVC pipe, ASTM 1785. Install per ASTM D 2321. Fittings: Schedule 40 DWV PVC, socket type fittings, ASTM 2665. Joints: Solvent joints for PVC, ASTM D-2564. (PVC piping is not acceptable for waste piping receiving discharge higher than 130 degrees F, cast iron piping is to be installed at the central plant.
mechanical rooms and at all laundry and kitchen equipment discharges.)

c. Single and double sanitary tee fittings are not allowed for the piping to any plumbing fixture; combination wye and eighth bend fittings shall be installed.
d. Double combination fittings shall not be used for connections to horizontal drainage piping; single wye and eighth bend fittings shall be used for all connections.
e. Foam core PVC piping is not acceptable for any drainage system.
f. All cast iron pipe and fittings shall carry an NSF International listing.

F. Sanitary, Waste and Vent Systems and Storm Drainage Systems Above Ground

1. Piping Systems

a. Basis of Design

1) No-hub cast iron soil pipe per CISPI 301 and ASTM A888. Fittings: No-hub cast iron fittings per CISPI 301 and ASTM A888. Joints: Joints for no-hub pipe and fittings shall be per CISPI 310, with stainless steel clamps and neoprene sleeve conforming to ASTM D 564. Heavy duty couplings are required on no-hub systems at the base of stack and vertical to horizontal offsets on all sanitary, waste and storm drainage systems. Heavy duty couplings shall conform to the requirements of ASTM Standard C-1540 and shall be type 304 stainless steel shielded couplings with stainless steel worm gear clamps, 15 psi working pressure. Acceptable manufacturers: Husky SD 4000 or Clamp-All 125.

2) Type DWV copper tube per ASTM B-306 and ANSI H-23.6. Fittings: DWV solder joint fittings per ANSI B16.29 or B16.23. Joints: All solder joints shall be made with a solder consisting of 95% tin and 5% antimony.

3) Single and double sanitary tee fittings are not allowed for the piping to any plumbing fixture; combination wye and eighth bend fittings shall be installed.

4) Double combination fittings shall not be used for connections to horizontal drainage piping; single wye and eighth bend fittings shall be used for all connections.

5) All cast iron pipe and fittings shall carry an NSF International listing.

b. Single and double sanitary tee fittings are not allowed for the piping to any plumbing fixture; combination wye and eighth bend fittings shall be installed.
c. Double combination fittings shall not be used for connections to horizontal drainage piping; single wye and eighth bend fittings shall be used for all connections.
d. Foam core PVC piping is not acceptable for any drainage system.
e. All cast iron pipe and fittings shall carry an NSF International listing.

G. ProSet Fittings

1. Cast in place fire penetration sleeves such as ProSet and Holdrite Hydro Flame may be installed in lieu of block-outs and/or steel sleeves only in areas where the design ceiling clearances are maintained.
2. Code Red stack assemblies manufactured by ProSet Systems are not an acceptable fire stopping method for any system.

2.4 VALVES, FLANGES AND UNIONS

A. General

1. All systems under this section shall be provided with valves to permit complete and sectional control of the system. They shall be located to permit easy operation, replacement and repair. They shall be installed where shown on the Drawings, or as herein specified. Valves to comply with NSF 61-G, NSF 61, and NSF 372. Valves shall be as manufactured by one of the following companies: American, Anvil International, FNW, Kennedy, Kitz, Milwaukee, Nibco, Powell, Stockham, Victaulic, Watts, or approved equal, and shall conform to description listed below.

2. Control valves shall be provided for the domestic hot and cold water supply to all risers and specific areas such as fixture groups, equipment, hose bibbs and wall hydrants. Valves shall be located in back-of-house or service areas with access panels or above lay-in ceilings. No access panels will be permitted in public spaces with gypsum ceilings.

B. Valve Description

1. Gate Valves
   a. 2-1/2" and larger, Victaulic Series 771V grooved ends (steel pipe), Stockham G-634, 175 lb. flanged OS&Y.
   b. 2" and smaller, Milwaukee UP149, low lead, 125 lb., sweat connection. 2-1/2" and larger, Victaulic MasterSeal (steel pipe) and Series 608 (copper tubing); Milwaukee Fig. F-2885, 125 lb., flanged or Apollo 141WD-SE-1 lead free Butterfly valve with 10 pos. lever handle.
   c. 8" and larger, Apollo141WD-SE-2 lead free Butterfly valve with gear operator.
   d. 2-1/2" and smaller, Milwaukee BB-SC100, threaded.

2. Check Valves
   a. 2" and smaller, Milwaukee UP509, 200 lb., threaded, low lead.
   b. 2" and larger, Victaulic Series 716, grooved ends.
   c. 2-1/2" and larger, Milwaukee Fig. F-2974, 125 lb. flanged.
   d. 2-1/2" and larger, Stockham G-939, 175 lb. flange.

3. Ball Valves
   a. 2" and smaller, Milwaukee UPBA 100.

4. Plug Valves (Natural/Propane Gas System)
   a. 1/2" and larger, Rockwell Nordstrom Fig. 142 or 143 lubricated plug valve, threaded or flanged as required, wrench operated.
   b. 1/2" through 2", two-piece full port brass ball valve, FM and AGA approved, Watts series FBV-3 or equal.

5. Balancing Valves (Hot Water Recirculation)
a. Balancing valves shall be venturi orifice type, bronze or brass body globe type or with brass or chrome ball, a minimum of two differential pressure read-out ports, 300 psi minimum working pressure. A compatible positive shutoff ball valve with memory stop is to be provided if not included with the balancing valve assembly.

b. Balancing valves shall be Victaulic Series 786 / 787, Flow Design Incorporated (FDI) model AC or MC or approved equal by ITT or Bell and Gossett.

c. Ball valves are not acceptable for balancing the hot water return system.

6. Backflow Preventers

a. Backflow preventers shall be installed at all locations required by code and local authorities, at all connections to mechanical equipment, and elsewhere as shown on the Drawings. Backflow preventers shall be reduced pressure principle type and shall be a complete assembly including tight-closing shutoff valves before and after the device. The design shall include test cocks and a pressure-differential relief seating check valves. The device shall meet the requirements of and be certified by ASSE Standard 1013, AWWA Standard C-506, NSF 61-G, NSF 61, NSF 372, and USC Foundation for Cross-Connection Control. A strainer shall be located upstream of the device. Route relief outlet from cone receptor to an air gap fitting for discharge to sanitary sewer.

b. Acceptable manufacturers are Ames Company, Apollo Valves, Hersey Products, Watts Regulator, and Zurn-Wilkins.

7. Class II turbine type water meters shall be installed downstream of the backflow preventer, on the domestic water supply to HVAC equipment make-up, irrigation supply, and pool/fountain supply to allow for a reduction in sewer rate charges.

8. Pressure Reducing Valves

a. A duplex pressure reducing valve station shall be provided on all domestic water systems greater than 80 psi.

9. Flanges

a. All flanges shall be faced and drilled for not less than 125 pounds steam working pressure complete with necessary adapter, and shall be of size and material of adjacent piping. All flanges shall be faced (raised or flat) to be compatible with connecting valves, equipment, etc. The connection of one raised face flange to a flat face flange shall not be permitted.

10. Unions and Joints

a. Unions on drainage pipes on fixture side of traps may be slip or flanged joints with soft rubber washers or gaskets. Unions 2" and smaller on copper pipe shall be all brass with ground joint and shall be 250# copper to copper. Unions above 2" shall be flanged with gaskets. Provide union at water and gas connection to all equipment, except plumbing fixtures.
1) Unions and flanges for servicing and disconnect are not required in installations using grooved joint couplings. (The couplings shall serve as disconnect points.)

2.5 CLEANOUTS

A. Cleanouts shall be provided where indicated on Drawings and elsewhere as required by code.

1. Cleanouts in pipelines shall consist of cast iron ferrule and heavy duty cleanout plug with square head as scheduled on the Drawings. Where piping is concealed in floors or walls cleanouts shall be installed in or near surface of floor or walls and have countersunk plugs with covers.

B. Cleanouts shall be provided at the base of the stack on all sanitary, waste and drainage stacks. Base of stack cleanouts on piping located within walls or partitions shall be cast iron cleanout tee with countersunk plug and chromium-plated round access cover, J.R. Smith figure 4530 or approved equal.

C. Base of stack cleanouts on hotel, condominium student housing, multi-family projects, etc. shall have the stack located behind the water closet at the lowest level to allow for concealing the base of stack cleanout behind the tank of the water closet.

D. Brass cleanouts shall be solid nut construction.

E. Provide Owner with three (3) wrenches for removing flush cleanout plugs.

2.6 FLOOR DRAINS

A. Setting Grades

1. The plumbing contractor shall obtain exact elevation of finished grade at the top of the drains prior to setting any drains. Drains installed in excess of 1/4" below the adjacent finished floor shall be removed and reset to the correct elevation.

B. Drain Types

1. All floor drain outlets shall be of size noted on the Drawings. All drains shall be equal to the assembly specified. Acceptable manufacturers are as follows: Josam Co., Zurn Co., J.R. Smith Co., Wade, Watts, Precision Plumbing or approved equal. Drains shall be acid-resisting where indicated.

2. Floor drains noted as FD “G” for use in public spaces such as Restrooms, Locker Rooms, Showers, etc., shall be general purpose type. Drains shall be cast iron with 6" square nickel bronze strainer and trap primer connection. Drains shall be Jay R. Smith Figure 2005B-L-B6-P050 or approved equal.

3. Floor drains noted as FD “F” for use at equipment discharge areas requiring a funnel shall be general purpose type. Drains shall be cast iron with 6" square nickel bronze strainer and sediment bucket with 4" diameter secured funnel, and trap primer connection. Drains shall be Jay R. Smith Figure 2005/2010-B6-F12-B series or approved equal.

4. Floor drains noted as FD “M” for use in mechanical rooms shall be heavy duty type. Drains shall be cast iron shallow type, 12" diameter with ductile iron tractor grate, sediment bucket, and trap primer connection. Secured funnels shall be
provided on all drains receiving condensate discharge to eliminate overflow or spillage. Drains shall be Jay R. Smith Figure 2142 series or approved equal. Drains located within rooms considered to be a plenum are to be provided with a deep seal trap and trap primer.

5. Floor drains noted as FD “TD” for use at trench drains in parking deck areas shall be Zurn flow-thru system, Z-812 Series, 12” wide, 4” outlets, Z-812-HPD ductile iron heel proof grate.

6. Floor or hub drains located within rooms considered to be a plenum are to be provided with a deep seal trap and trap primer.

7. Unless otherwise noted, acceptable manufacturers shall be Josam, Jay R. Smith, Mifab, Watts, and Zurn.

C. Trap Primers

1. Drains not receiving a continuous discharge are to be provided with an automatic trap primer.

2. Trap primers shall be in-line type actuated by flow independent of pressure, pressure activated primers are not acceptable. Josam models 88250 and 88300.

2.7 ACCESS PANELS

A. Group valves together above suspended ceilings, walls, furred spaces to minimize the number of access panels, but with all valves freely accessible for maintenance. Locate all valves within 1'-0" of access point.

B. Furnish access panels of proper size to service concealed valves and cleanouts. Panels shall be of the proper type for material in which they occur and are to be furnished by the Contractor, but installed by the particular trade for the material within which the access panel is installed.

C. Panels shall have flush doors with No.14 USCG steel door and trim No. 16 USCG steel frame, metal wings for keying into construction, concealed hinges, and screwdriver operated stainless steel cam lock. Panels shall be shop coated with one coat of zinc chromate primer. Valves above removable ceilings shall have tile clips by the Contractor for identification.

D. Access panels are not allowed in gypsum ceilings in public spaces.

2.8 INSULATION

A. The following shall be insulated:

1. All domestic cold water piping above grade except at horizontal chase branch piping to individual plumbing fixtures.

2. All hot water and hot water return piping except at horizontal chase branch piping to individual plumbing fixtures.

3. All hot and cold water piping exposed to areas subject to freezing, refer to “Heat Cable for Freeze Protection of Piping” under Part 2 of Section 15400 for additional requirements.

B. Domestic hot, cold, hot water recirculation, primary storm drainage, and waste drainage piping shall be insulated with 4 lb. density sectional fiberglass insulation with a thermal conductivity not to exceed 0.24 with white all service jacket and vapor barrier. All joints
15400 - 18

and seams shall be sealed vapor tight. All seams and staples shall then be covered with “All Service Jacket” three-inch wide tape.

C. All interior horizontal storm drainage piping systems and roof drain bodies are to be insulated with blanket type glass fiber bonded with thermosetting resin with white vinyl vapor retarding facing, 2” wide stapling/taping tab.

D. Materials as specified in this section shall be manufactured by CertainTeed, Johns Manville, Knauf, Owens Corning or equal. Insulation thicknesses shall be as shown in the following table:

<table>
<thead>
<tr>
<th>Piping System Types</th>
<th>Fluid Temperature Range</th>
<th>1 in. and Less</th>
<th>1-1/4 to 2 in.</th>
<th>2-1/2 to 4 in.</th>
<th>5 and 6 in.</th>
<th>8 in. and Larger</th>
</tr>
</thead>
<tbody>
<tr>
<td>Domestic Water</td>
<td>Ambient/Ambient</td>
<td>0.5</td>
<td>1.0</td>
<td>1.0</td>
<td>1.0</td>
<td>–</td>
</tr>
<tr>
<td>Domestic Hot Water and Hot Water Recirculation</td>
<td>43-71/110-160</td>
<td>1.0</td>
<td>1.0</td>
<td>1.5</td>
<td>1.5</td>
<td>–</td>
</tr>
<tr>
<td>Above Grade Drains and Piping Receiving Condensate or Ice Machine Discharge</td>
<td>4.5-15.5/40-60</td>
<td>0.5</td>
<td>1.0</td>
<td>1.0</td>
<td>1.5</td>
<td>–</td>
</tr>
<tr>
<td>Horizontal Storm Drainage</td>
<td>Ambient/Ambient</td>
<td>–</td>
<td>–</td>
<td>1.0</td>
<td>1.0</td>
<td>1.0</td>
</tr>
</tbody>
</table>

2.9 HEAT CABLE FOR FREEZE PROTECTION OF PIPING

A. Provide electric heat tracing on all domestic water piping and sanitary traps exposed to areas subject to freezing.

B. Provide a complete UL Listed, CSA Certified, or FM Approved system of heating cables, components, and controls to prevent pipes from freezing.

C. Electric heat cable shall be installed linearly along the bottom of the pipe and allowance shall be made for all fittings, valves, pipe supports, etc. Cable shall be installed prior to insulation of the piping system.

D. Electric cable shall be capable of maintaining a minimum water temperature of 40 degrees F at an ambient air temperature of 0 degrees F.

E. The electric cable shall be the self-regulating type that responds to varying localized temperature conditions by varying the heat output along its length. This shall be accomplished by a self-regulating core, which varies its resistance continuously with changes in temperature. A constant wattage heater is unacceptable.

F. Provide a thermostat control, which de-energizes the heating cable when the ambient air temperature is above 40 degrees F (adjustable). The heat cable shall be entirely self-regulating while energized.

G. Provide all power connection hardware, splices, end seals, etc., to accomplish installation. All hardware shall be by the same manufacturer as the cable.
H. Electric heating cable and accessories shall be UL Listed. Electric heating cable shall conform to all requirements of Division 16 - Electrical Requirements.

I. Electric heating cable shall be Raychem XL-Trace or approved equal, 8 watts per foot.

J. All piping shall be insulated with 1" thick fiberglass insulation.

K. Heating-cable circuit shall be protected by a ground-fault device for equipment protection. This requirement is in accordance with section 427-22 of the NEC-2002.

L. All heating cable components shall be UL Listed, CSA Certified, or FM Approved for use as part of the system to provide pipe freeze protection. Component enclosures shall be rated NEMA 4X to prevent water ingress and corrosion. Installation shall not require the installing contractor to cut into the heating-cable core to expose the bus wires. Connection systems that require the installing contractor to strip the bus wires or that use crimps or terminal blocks, shall not be acceptable.

2.10 PIPE SUPPORTS AND HANGERS

A. All piping shall be supported by means of hanger rods and pipe hangers from roof or floor structure using supplementary steel and/or lagbolts. Water supply pipe connecting to pumps, equipment, fixtures or fixture supplies shall be made rigid at the connection point.

1. Piping shall be supported from new concrete construction with Anvil International Fig. 282 inserts or drilled expansion anchors.
2. Piping shall be supported from new steel construction with Anvil International Fig. 131 beam clamp, Fig. 61 beam clamp, Fig. 66 welded beam attachment or Fig. 60 washer plate with all-thread rod.
3. Piping and brackets shall be supported from hollow block construction using drilled masonry holes and cadmium plated toggle bolts.
4. Piping shall be supported from wood truss construction with plated lag screws or bolts, B-3227 and B-3228.
5. Pipe supports shall not be attached to floor or roof deck.
6. Acceptable manufacturers are: Anvil, B-Line and FNW.

B. Unless otherwise noted, hangers and clamps shall be as listed below (all model numbers are B-Line Systems):

1. Cast iron/steel pipe - B3100 or B3109.
2. Insulated water pipe - B3100 or B3109 with B3151 placed over insulation protection saddle.
3. Uninsulated bare copper pipe - B3170 CTC plastic coated.
4. All supports and mounting hardware are to be galvanized, cadmium plated, or factory enamel painted.
5. All supports on insulated piping systems shall be sized to fit outside the insulation and shall be provided with insulation inserts and shields at each hanger or support point.

C. Branch piping to fixtures in chases shall be supported with plastic or copper clamp type supports:


D. Maximum spacing between pipe hangers shall be:

1. Steel pipe
   a. 1-1/4" and smaller: 6'-0"
   b. 1-1/2" – 2": 8'-0"
   c. 2-1/2" and larger: 10'-0"

2. Cast iron soil pipe: 2" and larger: 10'-0"

3. Copper tubing:
   a. 1/2" – 1-1/4": 5'-0"
   b. 1-1/2" – 2": 8'-0"
   c. 2-1/2" and larger: 10'-0"

4. PVC/CPVC and all plastic pipe:
   a. 1-1/4" and smaller: 3'-0"
   b. 1-1/2" and larger: 4'-0"

5. Pex Piping
   a. 1" and smaller: 18"
   b. 1¼" inch and larger: 32"

E. At least one hanger shall occur within 2'-0" from where change in direction takes place. Where pipes extend down or up to other floors, pipe clamps shall be provided on each floor to support vertical risers. Vertical piping drops shall be rigidly anchored to structure at the top and bottom offsets and at eight foot increments along the vertical drop.

F. Special approved hangers that require less installation space are to be used where required due to ceiling space limitations.

G. All connections to pumps and other vibrating machinery shall be provided with stainless steel braided flexible hose connections. Connections to potable water systems shall meet ANSI/NSF 61 design standards.

### 2.11 WATER HEATERS – ELECTRIC

A. Provide electric storage type water heaters as specified on the Drawings.

B. Water heater shall carry a UL certification for 150 psi working pressure, an ASME temperature and pressure relief valve (T and P) sized for the heater, vacuum relief valve, immersion thermostat, glass lined tank, temperature gauge on outlet, and manual reset high limit control.

C. Provide a metal drain pan and 3" high concrete housekeeping pad at each water heater. Water heaters greater than 10 gallons shall be floor mounted.

D. Provide a combination ball/relief valve on the domestic water supply sized as indicated on the Drawings, Watts series LFBRV or approved equal.
E. Water heaters that are not supplied with integral heat traps and serving non-circulating systems shall be provided with heat traps on the supply and discharge piping associated with the equipment. A check valve and expansion tank can be utilized in lieu of the supply side heat trap.

F. The water heater shall carry a five-year minimum limited warranty for tank leakage.

G. Electric water heaters shall be as manufactured by:

1. A.O. Smith
2. Bradford White
3. Lochinvar
4. State

2.12 FLAShING

A. Vent pipes passing through roof shall be flashed watertight.

B. The roof connections shall meet the approval of the manufacturer of the roofing materials and shall comply with the roof bond requirements.

C. All vent piping shall be offset above ceilings or in attic space and as shown on the Drawings to penetrate roofs on the least visible sides of building.

2.13 FLOOR, WALL AND CEILING PLATES

A. Furnish and install heavy gauge chromium plated steel wall and ceiling plates on all exposed pipes in finished areas where they pass through walls, ceilings, etc. Plates shall be of type that will remain permanently in position and where pipes are insulated they shall be of size necessary to cover insulated pipe.

2.14 GALVANIC PROTECTION

A. Insulate joints between dissimilar metals with suitable isolation gasket and bolts with fiber ferrules and washers and/or suitable armored insulation fittings by Clearflow, Crane, Capital, or Epco, so there will be no contact between the metals or with insulating bushings.

2.15 PIPING SYSTEMS IDENTIFICATION

A. A marker showing the service and an arrow indicating the direction of flow shall be applied on all of the following piping systems applicable to the project installed under this section of the Specifications:

1. Domestic hot, cold and hot water recirculation water piping
2. Gas piping
3. Sanitary, waste and vent piping

B. Piping identification shall be applied on all piping systems in areas of exposed construction and in areas with accessible or lay-in ceilings. The piping shall be labeled at each wall and floor penetration (both sides), and at connections to equipment. In addition, straight runs of piping shall be labeled at intervals not greater than 25 feet.
C. The letter size and background color shall conform to the Identification of Pipe System ANSI A-13-1. The vinyl plastic markers shall be as manufactured by Seton Name-Plate Company, W. H. Brady Company, or Westline products.

D. Each valve in the Plumbing and Fire Protection systems is to be provided with an individually numbered valve tag.

E. Valve tags are to be brass or plastic laminate, 1-1/2" minimum diameter with brass chain and hook for securing to the valve.

F. Valve tags will include a “P” or “FP” lettering designation to indicate the appropriate system. Numbering shall be consecutive for each service of either the Plumbing or Fire Protection systems.

G. A printed list or schematic drawing shall be compiled for each system indicating the location and detailed description of the system or equipment served.

H. One copy of each list shall be framed and mounted at the location designated by the Building Engineer. An additional copy of each list is to be included in the Operations and Maintenance Manual.

2.16 EQUIPMENT LABELING

A. All equipment shall be labeled. This shall include all pumps, water heaters, storage tanks, and other similar equipment.

B. Equipment labeling shall be one of the following, unless noted or specified otherwise.
   1. Permanently attached plastic laminate signs with 1” high lettering.
   2. Stencil painted identification, 2” high letters, with standard fiberboard stencils and standard black (or other appropriate color) exterior stencil enamel.

PART 3 - EXECUTION

3.1 GENERAL REQUIREMENTS

A. All equipment and materials shall be completely installed, adjusted, and fully operational with all accessories and connections.

B. Equipment, piping, ductwork, etc. shall fit into the spaces provided in the building and shall be installed at such times and in such a manner as to avoid damage and as required by the job progress. The Contractor shall coordinate work with other trades and locate work described herein to avoid interferences with structural, electrical and architectural work. Equipment, accessories and similar items requiring normal servicing or maintenance shall be accessible.

C. The Engineer reserves the right to direct the removal of any item which, in his opinion, does not present an orderly and reasonably neat or workmanlike appearance. Such removal and replacement shall be done when directed by the Engineer and without additional cost to the Owner.
D. Mounting heights, unless otherwise noted, are to the finished bottom of the device.

E. All work shall be designed and installed to comply with the requirements for the seismic design category and use group for the area in which the building is constructed.

### 3.2 EXCAVATION, TRENCHING AND BACKFILLING

A. The Contractor shall perform all excavation to install the work herein specified and as indicated on the Drawings. During excavation, material for backfilling shall be piled back from the banks of the trench to avoid overloading and to prevent slides and cave-ins. All excavated materials not to be used for backfill shall be removed and disposed of by the Contractor. Grading shall be done to prevent surface water from flowing into trenches and others excavation and any water accumulating therein shall be removed by pumping. All excavation shall be made by open cut. No tunneling or boring shall be done except under pavement.

B. The bottom of the trenches shall be graded to provide uniform bearing and support for conduits, cables, or duct bank on undisturbed soil at every point along its entire length. Overdepths shall be backfilled with loose, granular, moist earth, and tamped in 12" layers. Remove unstable soil that is not capable of supporting equipment or installation and replace with specified material for a minimum of 12" below invert of equipment or installation.

C. The trenches shall be backfilled with the excavated materials approved for backfilling, consisting of earth, loam, sandy clay, sand and gravel or soft shale, free from large clods of earth and stones, deposited in 6" layers and tamped until the crown of the pipe is covered by a minimum of 6" of tamped earth. The backfill under and beside the pipe shall be compacted for pipe support. Backfill shall be brought up evenly on both sides of the pipe so that the pipe remains aligned. In instances where the manufacturer's installation instructions for materials are more restrictive than those prescribed by the code, the material shall be installed in accordance with the more restrictive requirement. The backfilling shall be carried on simultaneously on both sides of the trench so that injurious pressures do not occur. The compaction of the filled trench shall be at least equal to 95% of the maximum density as determined by the Standard Proctor Test. Settling the backfill with water will not be permitted. Reopen any trenches not meeting compaction requirements or where settlement occurs, refill, compact, and restore the surface to the grade and compaction indicated, mounded over and smoothed off. A metallic lined underground warning tape shall be provided 12" below finished grade. The tape shall be identified as to the type of line per ANSI standard nomenclature and color.

D. Provide a layer of sand at least 6" deep under all plastic pipe installed in soil. Bell holes shall be excavated to ensure that the sewer pipe rests for its entire length upon a solid trench bottom.

E. Perform excavation and backfilling work in accordance with applicable portions of the earthwork section.

### 3.3 STORAGE AND PROTECTION OF MATERIALS

A. During construction, all equipment shall be properly protected against damage, defacing and freezing with shipping cartons, plastic sheeting, shipping covers, etc.
B. All open ends of piping and equipment shall be sealed with nipples and caps, plugs, test plugs until final connection to system is made.

C. All equipment and piping shall be protected to prevent entrance of foreign matter and debris by covering exposed openings during construction.

D. Handle and store materials in accordance with manufacturer’s and supplier’s recommendations and in manner to prevent damage to materials during storage and handling. Replace damaged materials.

E. Equipment and materials shall not be installed until such time as the environmental conditions of the job site are suitable to protect the equipment or materials. Equipment or materials damaged or which are subjected to these elements are unacceptable and shall be removed from the premises and replaced.

3.4 CUTTING AND PATCHING

A. Work shall include all cutting, patching, masonry and carpentry required as part of the equipment installation when not provided by other sections of these specifications.

B. All work shall be performed as specified under architectural specification section for cutting and patching.

3.5 CONCRETE WORK

A. Construct curbs, pads, vaults and similar supports for equipment where required.

B. Provide 3” thick housekeeping pads at floor mounted equipment a minimum of 3” larger than the entire area occupied by equipment. Dowel pads to structural slab.

C. Perform concrete work in accordance with applicable portions of Concrete sections. Minimum compressive strength of concrete shall be same as specified for slabs on grade.

3.6 CLEANING

A. At all times, the premises shall be kept reasonably clean and free of undue amounts of waste, trash and debris by periodic cleaning and removal. After completion, all foreign material, trash and other debris shall be removed from the job site.

B. After all equipment has been installed, but prior to testing and balancing, all equipment, piping, etc. shall be thoroughly cleaned both inside and out.

C. After testing and balancing of systems as specified and just prior to Owner review and acceptance, all systems shall be finally cleaned and shall be left ready for use.

3.7 PAINTING

A. Painting, except as otherwise specified, will be done under another section of the specifications, but the Contractor shall leave all surfaces of work free of rust, dirt and grease.
B. The Contractor shall touch-up to match original finish any equipment scratched in shipment or installation. Touch-up painting of plumbing equipment shall be part of the plumbing work.

C. Provide one coat of rust preventive primer on all new structural steel supports and new ferrous surfaces which are not galvanized (this includes piping systems). Rust preventative painting shall be part of the plumbing work.

D. All painting and coating shall match the original and shall conform to the requirements detailed in other sections of these specifications. Do not paint over nameplates on equipment, nonferrous hardware, accessories or trim.

3.8 EQUIPMENT SUPPORT

A. Major equipment supports (framed structural openings, etc.) shall be furnished and installed by others as shown on the Drawings. The plumbing work shall include, the furnishings and installation of all miscellaneous equipment supports, structural members, rods, clamps and hangers required to provide adequate support of all equipment.

B. Unless otherwise shown on the Drawings, all equipment, piping, and accessories shall be installed level, square, and plumb.

C. All equipment, piping, etc. supported by structural joists shall be supported by the top chord only of such joists. Hangers shall not be attached to the bottom chord of any joists.

3.9 PIPE PENETRATIONS

A. Sleeves shall be installed in all masonry or concrete walls, floors, roofs, etc. for pipe penetrations. Sleeves for pipe shall be Schedule 40 black steel. Sleeves shall be sized to provide a minimum of 1/4" clearance between the sleeve and pipe.

B. The 1/4" minimum clearance shall be provided between the sleeve and the insulation on insulated piping systems. A gap of the insulation shall be omitted at each side of a rated wall penetration to allow for the required fire stopping.

C. As far as possible, all pipe penetrations shall be provided for at the time of masonry or concrete construction. Where drilling is required, only core drills shall be used. Star drills shall not be used.

D. All pipes penetrating walls or floors of any construction shall be installed with escutcheon plates on both sides of the penetration securely fastened to the wall or floor. In exposed areas, escutcheon plates shall be chrome plated. All escutcheon plates shall be sized to completely conceal the penetration.

E. Pipe penetrations through exterior walls shall be sealed watertight with expandable link type seals by Thunderline, Linkseal or Engineer approved equal.

F. All pipe and duct penetrations of fire, smoke, or fire and smoke-rated assemblies shall be firestopped as required to retain the integrity of the UL rated assembly. Fire barrier products shall be as manufactured by Tremco, Hilti, 3M, Metacaulk, Nelson, or approved equal.

3.10 FLASHING
A. All piping penetrating roofs shall be flashed in an approved manner, shall be watertight, and shall conform to the requirements detailed in other sections of these specifications.

B. Flashing for piping shall be sheet lead of not less than 6 pounds per square foot, shall have a base not less than 2 square feet, and shall extend up over and into the open end of the pipe. All flashing shall be properly caulked and sealed.

3.11 PIPING SYSTEMS

A. Water Piping - General

1. Pipe used in piping assembly must be clean of dirt and obstructions and shall have ends square and reamed before putting into the fittings.
2. All piping must be true and plumb with proper pitch for draining of the soldering.
3. All domestic water lines serving flush valve fixtures and washing machines shall be protected from water hammer by shock absorbers. Where shock absorbers are required they shall be as manufactured by Josam Mfg. Company, J. R. Smith, Sioux Chief Ind., Precision Plumbing or Zurn Mfg. Co. and shall conform to the Plumbing and Drainage Institute published requirements.
4. All connections to water heaters, tanks and equipment shall be made with unions or flanges. Insulated piping systems shall be installed to provide space for insulation.
5. Grooved joint shall be installed in accordance with the manufacturer’s written recommendations. Grooved ends shall be clean and free from indentations, projections, or roll marks. The gasket shall be molded and produced by the coupling manufacturer of an elastomer suitable for the intended service. The coupling manufacturer’s factory trained representative shall provide on-site training for the contractor’s field personnel in the use of grooving tools and installation of product. The representative shall periodically visit the job site to ensure best practices in grooved product installation are being followed. (A distributor’s representative is not considered qualified to conduct the training.)
6. When installing Aquatherm Green piping for all Potable and Non Potable systems Contractor shall have received installation training from either the pipe/fitting manufacturer or designated representative before the project starts and shall furnish a copy of the “training documentation” within the project submittal for each installing individual showing current installation training.
7. When installing CPVC for all Potable and Non Potable systems Contractor shall have received installation training from either the pipe/fitting manufacturer or designated representative before the project starts and shall furnish a copy of the “training documentation” within the project submittal for each installing individual showing current installation training.
8. When installing Pex piping for all Potable and Non Potable systems Contractor shall have received installation training from either the pipe/fitting manufacturer or designated representative before the project starts and shall furnish a copy of the “training documentation” within the project submittal for each installing individual showing current installation training.

B. Sanitary Waste, Vent, Indirect Waste and Storm Drain Piping - General

1. Pipes shall be plumb and parallel to building walls, beams and columns unless otherwise indicated. All horizontal lines are to be evenly pitched and properly secured with iron or steel hangers, unless noted otherwise. A pitch of 1/4 inch per
lineal foot shall be maintained on all soil, and waste lines, wherever possible. Where long runs of piping require less pitch due to space restrictions, a less pitch shall be allowed on main lines four (4) inches and over in size, but in no event should any pipeline have a slope less than 1/8 inch per foot.

2. All soil and waste pipes shall be extended out full size through the roof or connected to a common vent as shown on the Drawings.

3. Main vent stacks shall run parallel to the soil pipe stacks and shall connect to the vent continuation of the soil stack at least three (3) feet above the rim of the highest plumbing fixtures on the stack. Vent stacks shall also be connected at the base or horizontal offset of the soil stack through a Y and 1/8 bend or an upright Y fittings. Offsets in vent pipe shall be made with 45 degree fittings wherever possible. Horizontal vent lines shall pitch toward the waste line.

4. Threaded joints shall have American National taper screw thread with graphite and oil compound applied to the male threads.

5. Sanitary and vent stacks are to be run straight and plumb and all offsets shall be made at an angle of not less than 45 degrees.

C. Mounting heights, unless otherwise noted, are to the centerline of the equipment and/or device.

3.12 TESTING OF PIPING SYSTEMS

A. General

1. All piping systems shall be subjected, before being insulated or concealed, to testing with water or air as noted and shall hold tight at the pressure head stated for the time interval required without adding air or water. While any system is being tested required head or pressure shall be maintained until all joints are inspected.

2. All tests shall be witnessed by the inspector having jurisdiction and the Owner's Representative, with a minimum 48-hour notice given these authorities.

3. All equipment, material, labor and testing mediums required for testing any of the various systems or any part thereof shall be furnished by the Contractor.

4. All connected equipment, accessories, etc. shall be isolated from piping systems prior to testing.

B. Sanitary Piping Systems

1. Water test shall be applied to these drainage systems either in their entirety or in sections as required, after rough piping has been installed. If the system is tested in sections, each opening shall be tightly closed except the highest opening in the section under test. All sections shall be tested with a minimum of 10 feet of head. In testing successive sections, at least the upper 10 feet of the next section shall be tested so that no joint of piping in the building shall be submitted to a test of less than 10 feet of head. The water shall be kept in the system for at least 30 minutes before inspection starts; the system shall then be made tight at all points.

2. Any points of the drainage systems to be tested with air instead of water shall be made by attaching an air compressor testing apparatus to any suitable opening and after closing all other inlets or outlets, forcing air into the system until there is a minimum gauge pressure of 5 psi. This pressure shall be held without the introduction of additional air for a period of at least 30 minutes.

3. Exterior connections shall be tested as part of the interior systems.
C. Interior Water Piping Systems
   1. Upon completion of the entire water supply system or a section of it as required, it shall be tested prior to connection of fixtures and proved tight under a water/air pressure of 150 psi. Pressure shall hold for a period of one hour without introducing additional water/air. Water used for testing shall be from a potable source of supply. Defective joints or piping shall be replaced as required and all piping shall be retested.

D. Exterior Water Piping System
   1. All exterior domestic water piping shall be tested to 150 psi for a period of two hours.

E. Defective Work
   1. If inspection or tests show defects, such defective work or material shall be replaced and inspection and tests shall be repeated. All repairs to piping shall be made with new material. Caulking of screwed joints or holes is not acceptable.

F. Additional Tests
   1. Provide all additional tests such as smoke or pressure tests as required by the regulations or as directed by authorities making the inspection.
   2. Provide for any repeated test as directed by the Owner's Representative, to make all systems tight as required.
   3. Visual inspections of joints, valves, etc. shall be made as directed by the Engineer.

3.13 DISINFECTION OF WATER SYSTEM – INTERIOR AND EXTERIOR

A. Prior to project completion, all potable water piping systems shall be disinfected per local code requirements.

B. Whenever the authority having jurisdiction does not specify disinfection procedures, the new water piping system shall be thoroughly disinfected with a solution containing not less than 50 parts per million of available chlorine. The chlorinating material shall be either liquid chlorine or sodium hydrochloride solution and shall be introduced into the system and drawn to all points in the system. The disinfection solution shall be allowed to remain in the system for a period of eight hours, during which period all valves and faucets shall be opened and closed several times. After disinfection, the solution shall be flushed from the system with clear water until the residual chlorine content is not greater than 0.2 parts per million.

C. This work is to be supervised or performed by an approved chemical testing laboratory and results sent to Engineer or his representative for verification.

3.14 DOMESTIC HOT WATER SYSTEM BALANCING

A. The test and balance contractor shall provide testing, adjusting and balancing of the hot water system, once the system is fully installed and operational. Preliminary and final reports shall be prepared and issued to the General Contractor, Architect and Engineer.

B. Preparation of the hot water system for balancing:
1. Confirm outlet temperature of the system at water heaters and/or storage tanks.
2. Verify recirculation pump operation and rotation.
3. Confirm/adjust setpoint of each individual riser balancing valve to flow a minimum of 0.5 gpm or as otherwise noted on the documents.

C. The test and balance report shall indicate the following:

1. Pressure, temperature and flow in gpm at the discharge side of each balancing valve referencing the valve tag number.
2. Pressure, temperature and flow in gpm at the suction side of each recirculating pump.

D. Copies of the final approved balancing report are to be included in the O and M manuals as noted in “Permits” under Part 1 of Section 15400.

3.15 FIXTURE CONNECTIONS AND SUPPORTS

A. Wall fixtures shall be hung by means of carrier type fixture supports as manufactured by J.R. Smith, Josam, Mifab, Wade or Zurn.

3.16 SLEEVES

A. Furnish and install pipe sleeves around all piping passing through masonry walls, floors, beams, etc. Sleeves shall be of such diameter as to allow pipe to pass through easily and permit expansion and contraction of pipe. Where pipes are insulated, the sleeves shall be of such diameter as to allow the insulated pipe to pass through easily. The sleeves shall be placed before the pouring of concrete and before construction of walls. Sleeves for vertical risers shall extend a minimum of 1” above the floor slab. Sleeves to outside walls below grade shall be caulked or provided with expansion type mechanical seals as required to make them waterproof.

3.17 INSTALLATION OF UNIONS

A. Unions shall be located as shown on plans and as required by equipment so piping and equipment can be easily dismantled. Unions shall not be installed in any location where they are not readily accessible.

3.18 TRAPS

A. All fixtures, drains, etc. shall be provided with traps, unless specifically shown or specified otherwise. Traps shall be set in an upright position, level and true, and shall be vented as shown and required. All exposed traps shall be provided with cleanout plugs.

3.19 CLEANOUT INSTALLATION

A. Furnish and install cleanouts in soil and waste lines as required by Code and/or job conditions, as shown on the Drawings and as follows: At or near the end of each branch and main drainage line, horizontal lines at intervals as required by code. All cleanouts shall be readily accessible, with plugs easily removable for cleanout lines. Cleanouts at the base of vertical piping shall be held within 2'-0" from finished floor unless otherwise indicated.
3.20 FLASHER INSTALLATION

A. All pipes passing through roofs shall be flashed in an approved manner. Flashing shall be watertight.

B. Roof connections shall meet the approval of the manufacturer of roofing material and shall comply with roof bond requirements.

3.21 EQUIPMENT AND MATERIAL PROTECTION

A. During construction all equipment shall be properly protected against damage, defacing and freezing with shipping cartons, plastic sheeting, shipping covers.

B. All open ends of piping and equipment shall be sealed with nipples and caps, plugs, test plugs until connection to system is made.

3.22 SPACE REQUIREMENTS

A. Piping, apparatus and equipment shall fit into the space provided in the building or within the property and shall be installed at such time and in such manner as to avoid damage to the building structure or property as required by the job progress. Equipment, apparatus and accessories requiring normal servicing or maintenance shall be made easily accessible.

END OF SECTION
PART 1 - GENERAL

1.1 GENERAL REQUIREMENTS

A. All work specified herein shall be accomplished in accordance with the applicable requirements of Section 15400 - Plumbing General.

1.2 WORK INCLUDED

A. Receipt, unloading, handling, proper storage and protection from damage of all materials.

B. Layout and coordination of work with other trades.

C. The work under this section shall include all labor, materials, accessories, services, and equipment necessary to furnish and install the plumbing fixtures, trim and supports, complete as indicated on the Drawings and as specified herein.

PART 2 - PRODUCTS

2.1 GENERAL

A. All fixtures shall be white, unless otherwise indicated.

B. All water closets shall have fully glazed trapways.

C. All exposed trim to be heavy polished chrome plated brass, unless otherwise indicated. Chrome plated escutcheons are to be provided on all exposed fixture and food service equipment supplies and waste lines.

D. Electric water coolers shall be ARI Certified and shall carry a UL Listing. Units shall use refrigerant which is approved for use without ozone depleting properties. All waterway components are to be certified as lead free.

E. All sinks and lavatories for use by the disabled shall have manufactured insulation shields on all supplies and P-traps per ADA requirements unless the vanities are provided with ADA compliant shrouds.

F. All exposed plumbing fixture items such as faucets and flush valves shall be provided with vandalproof trim.

2.2 CLEANOUTS

A. Cleanouts on exposed piping in unfinished areas shall be heavy duty cast iron with countersunk plug. Cleanouts shall be Jay R. Smith Figure 4220 or approved equal.

B. Cleanouts installed behind walls in finished areas shall be cast iron ferrule type for no-hub or service weight pipe with nickel bronze round frame and cover with securing screws. Cleanouts shall be Jay R. Smith Figure 4472T or approved equal.
C. Cleanouts installed in concrete floors shall be cast iron type with gasket seal ABS plug round adjustable ductile iron cover with securing screw and Speedi-Set outlet connection. Cleanouts shall be Jay R. Smith Figure 4231L-M or approved equal.

D. Cleanouts installed in tile floors shall be cast iron type with gasket seal ABS plug for easy removal, adjustable round nickel bronze top recessed for tile with securing screw and Speedi-Set outlet connection. Cleanouts shall be Jay R. Smith Figure 4151L or approved equal.

E. Cleanouts installed in carpeted areas shall be cast iron type with gasket seal ABS plug, nickel bronze round frame and cover with carpet marker. Cleanouts shall be Jay R. Smith 4031-Y or approved equal.

2.3 PLUMBING FIXTURES

A. The following is a list of acceptable manufacturers for the project:

1. Fixtures: American Standard, Kohler, Toto
2. Faucets: American Standard, Chicago Faucets, Kohler, Moen, Speakman, Symmons and Zurn
3. Stainless Steel Sinks: Elkay, Just, Kohler
4. Trim: American Standard, Brasscraft, Kohler, McGuire and Zurn
5. Drains, Carriers and Hydrants: Josam, Mifab, Prier, Jay R. Smith, Wade and Zurn

B. Plumbing fixtures shall be as scheduled below:

<table>
<thead>
<tr>
<th>Fixture</th>
<th>Description</th>
<th>Acceptable Manufacturers</th>
</tr>
</thead>
<tbody>
<tr>
<td>W1</td>
<td>Wall hung, 1.28-gallon flush valve, vitreous china, elongated, siphon jet, 1-1/2&quot; top spud, bolt caps, white. ADA fixture to be installed with top of seat 18&quot; above finished floor.</td>
<td>American Standard 2257.001</td>
</tr>
<tr>
<td>W2</td>
<td>CARRIER: Adjustable, horizontal and vertical series.</td>
<td>Smith 210 Series</td>
</tr>
<tr>
<td></td>
<td>FLUSH VALVE: 1.28-gallon flush, sensor operated, hardwired, 1-1/2&quot; top spud coupling, wall and spud flanges, vandalproof trim, chrome-plated.</td>
<td>Sloan Royal 111-1.28 ES-S TMO</td>
</tr>
<tr>
<td></td>
<td>SEAT: Commercial grade solid plastic, elongated, open front, stainless steel check hinge, white.</td>
<td>Beneke 523-SS</td>
</tr>
<tr>
<td>L1</td>
<td>LAVATORY: 19&quot; x 16&quot; O.D., 17&quot; x 14&quot; bowl, undercounter lavatory, vitreous china, unglazed rim, front overflow, white.</td>
<td>American Standard 0496.221</td>
</tr>
<tr>
<td>Description</td>
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<td>----------------------------------------------------------------------------</td>
<td></td>
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<tr>
<td><strong>FAUCET – PUBLIC – SENSOR:</strong> Single spout faucet with hardwired powered</td>
<td>American Standard 7059.205</td>
<td></td>
</tr>
<tr>
<td>sensor operation, 4&quot; escutcheon plate, undercounter thermostatic mixing</td>
<td>Kohler</td>
<td></td>
</tr>
<tr>
<td>valve, 0.5 gpm aerator, 1-1/4&quot; tailpiece, polished chrome finish.</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>SUPPLY:</strong> 1/2&quot; O.D. x 3/8&quot; O.D. angle supply, loose key stop, wall</td>
<td>Brasscraft SR1712A</td>
<td></td>
</tr>
<tr>
<td>flange, chrome plated.</td>
<td>Kohler K-7676</td>
<td></td>
</tr>
<tr>
<td><strong>DRAIN:</strong> 1-1/4&quot;, 17 ga. open grid strainer and tailpiece, provide 1-1/4&quot;</td>
<td>Kohler K-7715</td>
<td></td>
</tr>
<tr>
<td>&quot;, 17 ga. offset drain with open grid strainer at ADA locations, chrome</td>
<td>McGuire 155</td>
<td></td>
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<tr>
<td>plated.</td>
<td></td>
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<tr>
<td><strong>TRAP:</strong> 1-1/4&quot; x 1-1/2&quot;, 17 ga., adjustable trap with cleanout and wall</td>
<td>Kohler K-8999</td>
<td></td>
</tr>
<tr>
<td>flange, chrome finish.</td>
<td>McGuire 8902</td>
<td></td>
</tr>
<tr>
<td><strong>INSULATION KIT:</strong> Self-fastening vinyl insulation covers for drain,</td>
<td>Handi Lav-Guard Model 102</td>
<td></td>
</tr>
<tr>
<td>traps and supply piping with accessible angle valve insulation cover,</td>
<td>and 105</td>
<td></td>
</tr>
<tr>
<td>white, provide at all ADA locations.</td>
<td>McGuire PW2125WC</td>
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<tr>
<td><strong>L2 LAVATORY:</strong> 21&quot; x 18&quot;, wall hung lavatory, 4&quot; center, concealed</td>
<td>American Standard 0355.012</td>
<td></td>
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<tr>
<td>arms, front overflow and backsplash, white.</td>
<td>Kohler K-2005</td>
<td></td>
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<tr>
<td><strong>FAUCET – PUBLIC – SENSOR:</strong> Single spout faucet with hardwired powered</td>
<td>American Standard 7059.205</td>
<td></td>
</tr>
<tr>
<td>sensor operation, 4&quot; escutcheon plate, undercounter thermostatic mixing</td>
<td>Kohler</td>
<td></td>
</tr>
<tr>
<td>valve, 0.5 gpm aerator, 1-1/4&quot; tailpiece, polished chrome finish.</td>
<td></td>
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<tr>
<td><strong>SUPPLY:</strong> 1/2&quot; O.D. x 3/8&quot; O.D. angle supply, loose key stop, wall</td>
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<td></td>
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<tr>
<td>flange, chrome plated.</td>
<td>Kohler K-7676</td>
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</tr>
<tr>
<td><strong>DRAIN:</strong> 1-1/4&quot;, 17 ga. open grid strainer and tailpiece, provide 1-1/4&quot;</td>
<td>Kohler K-7715</td>
<td></td>
</tr>
<tr>
<td>&quot;, 17 ga. offset drain with open grid strainer at ADA locations, chrome</td>
<td>McGuire 155</td>
<td></td>
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<tr>
<td>plated.</td>
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<tr>
<td>Provide the required quantity of transformers and coordinate installation</td>
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<td>with the electrical contractor.</td>
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<tr>
<td><strong>TRAP:</strong> 1-1/4&quot; x 1-1/2&quot;, 17 ga., adjustable trap with cleanout and wall</td>
<td>Kohler K-8999</td>
<td></td>
</tr>
<tr>
<td>flange, chrome finish.</td>
<td>McGuire 8902</td>
<td></td>
</tr>
<tr>
<td><strong>INSULATION KIT:</strong> Self-fastening vinyl insulation covers for drain,</td>
<td>Handi Lav-Guard Model 102</td>
<td></td>
</tr>
<tr>
<td>traps and supply piping with accessible angle valve insulation cover,</td>
<td>and 105</td>
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<tr>
<td>white, provide at all ADA locations.</td>
<td>McGuire PW2125WC</td>
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<tr>
<td>TRAP:</td>
<td>1-1/4&quot; x 1-1/2&quot;, 17 ga., adjustable trap with cleanout and wall flange, chrome finish.</td>
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<tr>
<td></td>
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<td><strong>Kohler</strong> K-8999</td>
</tr>
<tr>
<td>INSULATION KIT:</td>
<td>Self-fastening, vinyl insulation covers for drain, traps and supply piping with accessible angle valve insulation cover, white. Provide at all ADA locations</td>
<td></td>
</tr>
<tr>
<td></td>
<td><strong>McGuire</strong> PW2125WC</td>
<td><strong>Handi Lav-Guard Model 102 and 105</strong></td>
</tr>
<tr>
<td>CARRIER:</td>
<td>Adjustable floor support with concealed arms.</td>
<td></td>
</tr>
<tr>
<td></td>
<td><strong>Smith</strong> 700 series</td>
<td></td>
</tr>
<tr>
<td>U1 U2</td>
<td>URINAL: Wall hung, siphon jet, 0.125 gallon flush, vitreous china, 3/4&quot; top spud, white.</td>
<td></td>
</tr>
<tr>
<td></td>
<td><strong>American Standard</strong> 6590.125</td>
<td><strong>Kohler</strong> K-4904-ET</td>
</tr>
<tr>
<td>SENSOR FLUSH VALVE:</td>
<td>Externally adjustable 0.125 gallon flush, 3/4&quot; top spud coupling, hardwired, sensor operated, wall and spud flanges, chrome plated.</td>
<td></td>
</tr>
<tr>
<td></td>
<td><strong>Sloan</strong> 186-0.125 ES-S</td>
<td><strong>Zurn</strong></td>
</tr>
<tr>
<td>CARRIER:</td>
<td>Adjustable fixture hanger support and lower plate with bearing studs.</td>
<td></td>
</tr>
<tr>
<td></td>
<td><strong>Jay R. Smith</strong> 635</td>
<td><strong>Zurn</strong> Z1222</td>
</tr>
<tr>
<td>SH1 SHOWER – PUBLIC:</td>
<td></td>
<td></td>
</tr>
<tr>
<td>SHOWER ENCLOSURE:</td>
<td>Refer to Architectural.</td>
<td></td>
</tr>
<tr>
<td>SHOWER VALVE/SHOWER HEAD:</td>
<td>Pressure balanced with integral check stops, adjustable temperature limit stops, lever handle. Ball joint shower head with adjustable spray, 2.5 gpm max. flow at 80 psi, one-piece arm and flange, polished chrome finish.</td>
<td></td>
</tr>
<tr>
<td></td>
<td><strong>American Standard</strong> 1495SS.502</td>
<td><strong>Kohler</strong> K-304-KS</td>
</tr>
<tr>
<td></td>
<td><strong>T212.710</strong></td>
<td><strong>K-T15121-4CP</strong></td>
</tr>
<tr>
<td>SHOWER DRAIN:</td>
<td>2&quot; floor drain type “G” with 4&quot; square nickel bronze strainer.</td>
<td></td>
</tr>
<tr>
<td></td>
<td><strong>American Standard</strong> 1660.440</td>
<td><strong>Kohler</strong> K-9660</td>
</tr>
<tr>
<td>SH2 SHOWER – PUBLIC – HANDICAPPED:</td>
<td></td>
<td></td>
</tr>
<tr>
<td>SHOWER ENCLOSURE:</td>
<td>Refer to Architectural.</td>
<td></td>
</tr>
<tr>
<td>SHOWER VALVE/SHOWER HEAD:</td>
<td>Pressure balanced with integral check stops, adjustable, temperature limit stops, lever handle. Ball joint shower head with adjustable spray, 2.5 gpm max. flow at 80 psi, one-piece arm and flange, polished chrome finish.</td>
<td></td>
</tr>
<tr>
<td></td>
<td><strong>American Standard</strong> 1495.502</td>
<td><strong>Kohler</strong> K-304-KS</td>
</tr>
<tr>
<td></td>
<td><strong>K-T15121-4CP</strong></td>
<td></td>
</tr>
<tr>
<td><strong>HAND SHOWER ASSEMBLY:</strong></td>
<td><strong>American Standard</strong></td>
<td><strong>Kohler</strong></td>
</tr>
<tr>
<td>Handheld shower with 69” chrome plated flexible hose, swivel connector, 24” long adjustable slide bar, vacuum breaker, elbow-supply, chrome finish.</td>
<td>1662.600</td>
<td>K-8520</td>
</tr>
<tr>
<td><strong>TRANSFER VALVE:</strong></td>
<td><strong>American Standard</strong></td>
<td><strong>Kohler</strong></td>
</tr>
<tr>
<td>Chrome plated transfer valve, lever handle.</td>
<td>1660.440</td>
<td>K-T9518-4-CP</td>
</tr>
<tr>
<td><strong>SHOWER DRAIN:</strong></td>
<td><strong>American Standard</strong></td>
<td><strong>Kohler</strong></td>
</tr>
<tr>
<td>2” floor drain type “G” with 4” square nickel bronze strainer.</td>
<td>1660.440</td>
<td>K-9660</td>
</tr>
<tr>
<td><strong>SINK – SINGLE BOWL:</strong></td>
<td><strong>Elkay</strong></td>
<td><strong>Just</strong></td>
</tr>
<tr>
<td>25” x 21” x 5-1/2”, nominal O.D. single bowl sink, stainless steel, four-hole punch, ADA compliant.</td>
<td>(Dayton GE-12521-L/R)</td>
<td>SL-ADA-2225-A-GR</td>
</tr>
<tr>
<td><strong>FAUCET:</strong></td>
<td><strong>American Standard</strong></td>
<td><strong>Kohler</strong></td>
</tr>
<tr>
<td>Blade handle kitchen sink faucet with swing spout and handspray, chrome plated. 1.5 gpm aerator.</td>
<td>4275.501</td>
<td>K-1054432</td>
</tr>
<tr>
<td><strong>DRAIN:</strong></td>
<td><strong>American Standard</strong></td>
<td><strong>Kohler</strong></td>
</tr>
<tr>
<td>Stainless steel strainer drain with removable crumb cup, 3-1/2” O.D., 1-1/2” tailpiece.</td>
<td>4320-024</td>
<td>K-8813</td>
</tr>
<tr>
<td><strong>LAUNDRY SOAK SINK:</strong></td>
<td><strong>Fiat</strong></td>
<td><strong>Swan</strong></td>
</tr>
<tr>
<td>Floor mounted double bowl laundry sink with deck mount faucet.</td>
<td>Model FLTD Model A1</td>
<td>Model PT-2</td>
</tr>
<tr>
<td><strong>FAUCET:</strong></td>
<td>A-1</td>
<td></td>
</tr>
<tr>
<td>Deck mount faucet with blade handles, 4” centers.</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>EWC1 ELECTRIC WATER COOLER EMPLOYEE – SINGLE BOWL:</strong></td>
<td><strong>Halsey-Taylor</strong></td>
<td><strong>Oasis</strong></td>
</tr>
<tr>
<td>Wall mounted barrier free cooler, front and side push button operation, heavy gauge stainless steel, unit to provide minimum 8 GPH of 50°F water with 90°F ambient and 80°F supply water temperature, vinyl finish.</td>
<td>HAC8FS-Q</td>
<td>P8AM</td>
</tr>
<tr>
<td><strong>SUPPLY:</strong></td>
<td><strong>McGuire</strong></td>
<td><strong>McGuire</strong></td>
</tr>
<tr>
<td>1/2” O.D. x 3/8” O.D., wheel handle stop.</td>
<td>ST07</td>
<td>8902</td>
</tr>
<tr>
<td><strong>TRAP:</strong></td>
<td><strong>Kohler</strong></td>
<td><strong>McGuire</strong></td>
</tr>
<tr>
<td>1-1/4” x 1-1/2”, 17 ga. adjustable trap with cleanout, chrome finish.</td>
<td>K-8999</td>
<td>8902</td>
</tr>
</tbody>
</table>
### PART 3 - EXECUTION

#### 3.1 INSTALLATION

A. All wall hung fixtures shall be supported on concealed chair carriers furnished complete with all necessary bolts, nuts, washers and gaskets unless noted otherwise. The adjustable nipple between the cast iron fitting and the closet bowl shall be threaded cast iron. Secure all floor pieces to floor slab.

B. All exposed piping in connection with fixtures shall be chromium plated. Where supply and waste lines pass through walls, provide chromium plated escutcheons and firmly secure in place.

C. Provide straight or angle supply valves on inlet supplies to all fixtures.

D. Fixtures, trim and methods of piping and installation shall conform to local plumbing code. All fixture types shall be the product of one manufacturer. All fixtures shall be white unless otherwise noted.

E. Bathtub waste and overflow fittings shall be provided with soldered metal connections or PVC solvent welded connections if required by code authorities to eliminate the requirement for access to the fitting.

F. Fixtures shall be cleaned, adjusted and left in proper working order before the project is turned over to the Owner. Flush and clean all faucet aerators prior to turn over. Adjust all faucet lever handles to be parallel to adjacent rear wall in the off position.

G. The Contractor shall furnish and install protective guards as required to protect fixtures against damage by normal operations of other trades. Bathtubs shall be provided with tub liners at all times during construction.

H. Caulk all floor and counter top mounted fixtures and behind all wall-hung plumbing fixtures with white, non-shrinking, silicone caulking eliminating all voids and cracks.

I. Coordinate the mounting height of all fixtures with the Architect prior to installation.
J. The Contractor shall obtain exact information relative to finish grade of the top of the floor drains. All floor drains shall be set flush with finished floors.

K. Cleanouts shall be provided where indicated on drawings and elsewhere as required by code.

L. Where test tees are installed at the base of the stack or on the stack, they may be used as a cleanout.

M. Provide the Owner with three (3) wrenches for removing flush cleanout plugs.

END OF SECTION
PART 1 - GENERAL

1.1 GENERAL REQUIREMENTS

A. General Conditions: Refer to the General Conditions, the Supplementary General Conditions and the Special Conditions, all provisions of which apply to work under this section as if written in full herein.

B. The scope of work described in these Specifications and/or indicated on the Drawings shall include (except where otherwise noted) the furnishing of all materials, equipment, appurtenances, accessories, connections, labor, etc. required and/or necessary to completely install, clean, inspect, adjust, test, balance and leave in safe and proper operating condition all systems. All work shall be accomplished by workmen skilled in the various trades involved.

C. The Drawings and Specifications are complementary to each other and what is called for by one shall be as binding as if called for by both. If a discrepancy exists between the Drawing and Specifications, the higher cost shall be included, and the Architect shall be notified of the discrepancy.

D. All work performed under this specification shall be accomplished in accordance with the requirements and provisions of Section 15000 - HVAC General.

1.2 SYSTEMS

A. Systems to be provided under the Fire Protection design section shall be as listed below. The connection point to the site utility service for the fire protection system shall be at 5'-0" from the exterior of the building unless specifically otherwise noted.

1. Automatic Sprinkler Systems
2. Automatic Dry Sprinkler Systems
3. Fire Department Valve Cabinets
4. Painting of exposed piping

1.3 QUALIFICATION OF CONTRACTORS

A. The Contractor for the fire protection installation shall be a certified fire protection contractor, licensed for the installation of automatic fire sprinkler systems and other fire protection equipment.

1.4 DESIGN STANDARDS

A. Fire Protection systems shall be designed and installed in accordance with the requirements of the following codes, standards and design guides:

3. National Fire Protection Association (NFPA) Standards:
   b. NFPA 13 - Installation of Sprinkler Systems
c. NFPA 14 - Installation of Standpipe and Hose Systems  
d. NFPA 20 - Installation of Centrifugal Fire Pumps  
e. NFPA 24 - Installation of Private Fire Service Mains  
f. NFPA 25 - Inspection, Testing, and Maintenance of Water-based Fire Protection Systems

4. Factory Mutual (FM) Approval Guide  
5. Underwriters Laboratories Inc. (UL)  
6. Owner’s Insurance Underwriter Requirements

B. Design Criteria

1. Upon award of the Contract, a new flow test from the two (2) hydrants nearest the site service entry is to be performed by the Contractor to confirm the flow and pressure characteristics of the existing water service. The completed flow test data along with a utility service map of the area is to be forwarded to the Engineer for confirmation of the existing water service.

2. The entire facility will be protected by an automatic sprinkler system supplied by combination fire standpipe/automatic sprinkler systems located within the building stairwells.

3. Automatic sprinkler systems shall be designed to the available domestic water pressure available and shall be hydraulically calculated for the following design standards:

a. NFPA 13 Systems

<table>
<thead>
<tr>
<th>Area/Usage</th>
<th>Hazard Classification</th>
<th>Density GPM/Sq. Ft.</th>
<th>Remote Area</th>
<th>Maximum Head Spacing</th>
<th>Interior Hose Stream</th>
</tr>
</thead>
<tbody>
<tr>
<td>Public Spaces, Lobbies, Corridors, Offices, Restaurants, Lounges, Meeting Rooms</td>
<td>Light</td>
<td>.10</td>
<td>1,500 sq. ft</td>
<td>225 sq. ft</td>
<td>100 gpm</td>
</tr>
<tr>
<td>Mechanical Rooms, Electrical Rooms, Elevator Equipment Rooms, Maintenance/Storage Rooms, Kitchen/Food Service Areas and Laundry</td>
<td>Ordinary Group 1</td>
<td>.15</td>
<td>1,500 sq. ft</td>
<td>130 sq. ft</td>
<td>250 gpm</td>
</tr>
<tr>
<td>Exterior loading docks (see NFPA 13-A5.3.2)</td>
<td>Ordinary Group 2</td>
<td>.20</td>
<td>1,500 sq. ft</td>
<td>130 sq. ft</td>
<td>250 gpm</td>
</tr>
<tr>
<td>Dry Pipe Systems: Parking Garages, Non-heated Attic Spaces, Ceiling Spaces, Porte Cochere and other spaces containing sprinkler piping that do not have alternate provisions to guarantee a 40° F temperature.</td>
<td>Ordinary Group 1</td>
<td>.15</td>
<td>1,950 sq. ft</td>
<td>130 sq. ft</td>
<td>250 gpm</td>
</tr>
</tbody>
</table>
4. The fire protection systems shall not be designed to operate if the residual pressure of the existing water service falls to 20 psi or lower at design flow requirements.

5. The fire protection system design shall include a minimum of 10 psi safety factor to allow for future losses in the water service pressure characteristics.

6. The maximum allowable system velocities shall not exceed 20 fps unless alternate criteria are required by the Owner's Insurance Underwriter.

7. Shelled areas for future tenant fit-up sprinkler systems shall be designed based on a maximum of 140 square feet per sprinkler. When sprinklers are exposed, branch line connections for sprinklers shall be a minimum of 1" size with 1" sprigs to upright sprinklers or 1" drops to pendent sprinklers to accommodate tenant fit-up.

C. Combination Standpipe/Automatic Sprinkler Risers

1. Combined standpipe/sprinkler risers or Class I standpipe risers with fire department valves shall be installed in each stairwell within the facility. Automatic sprinkler connections will be supplied from combined standpipe/sprinkler risers with a floor control valve assembly, including check valve, at the required locations. Additional standpipes with 2-1/2" fire department valves are to be provided at required locations throughout the facility per the requirements of NFPA 14.

2. Temporary standpipes must be provided during construction and installed before progress of construction exceeds 40 feet in height, as required by section 1413 of the IFC.

3. Standpipes will be designed to provide a minimum of 500 gpm. Fire mains supplying standpipes will be hydraulically designed and sized to provide a minimum of 500 gpm at the most remote standpipe and 250 gpm for each additional standpipe to a maximum of 1,000 gpm.

4. The fire protection system shall provide 100 psi at the most remote fire department connection; 65 psi may be allowed as a deductive alternate where acceptable to the local authorities and all applicable Owner design criteria.

5. Standpipes and/or sprinkler connections that are equipped with pressure regulating valves shall be provided with 3" drain risers.

D. Fire Protection System Alarms

1. The fire protection contractor shall coordinate location and function of all flow, air pressure, supervisory switches, and other dry contacts with the fire alarm contractor.

2. All control valves in the fire protection system shall be provided with supervisory switches wired for annunciation at the main FACP.

3. Automatic sprinkler system connections shall be provided with flow switches adjacent to the zone control valve wired for annunciation at the main FACP.

4. Upright automatic sprinklers will be provided in all elevator shafts and elevator machine rooms. The service to each of these spaces shall be provided with an individual control valve with a supervisory switch and a flow switch located in an adjacent room and wired for annunciation at the main Fire Alarm Control Panel (FACP).
1.5 ORDINANCES, PERMITS AND DRAWING APPROVALS

A. The Contractor shall file all requisite plans relating to this section of the specifications with the proper authorities, secure all permits and approvals and pay all resultant fees for work done under this section.

B. All fire protection work shall comply with all laws, ordinances, rules, regulations and standards of the City, County, State and the Owner’s Insurance Underwriter; all applicable sections of the National Fire Codes and the Codes and Standards of the National Fire Protection Association.

C. If code or other requirements exceed the provisions shown on the Contract Documents, the Architect shall be notified in writing. Where requirements of the Contract Documents exceed Code requirements, work shall be furnished and installed in accordance with the Contract Documents. Any work done contrary to these requirements shall be removed and replaced at the Contractor’s expense.

1.6 EQUIPMENT, MATERIALS, BID BASIS

A. Manufacturers’ names, model numbers, etc. as specified on the Drawings and herein are for the purpose of describing type, capacity, function and quality of equipment and materials required.

B. Unless “approved equal” is specifically stated, bids shall be based on equipment named in the Specifications or on the Drawings as “base” products.

C. “Equal product” and “approved equal” items listed shall conform to specified base items and shall be substantially equal in size, weight, construction quality and capacities. The alternate equipment and materials shall be submitted as full equivalent to the equipment and materials specified, with sufficient supportive documentation and technical literature to demonstrate quality, performance, and workmanship without doubt or question.

D. The Contractor shall coordinate the installation of all fire protection equipment proposed for use in this project with all building trades (architectural, structural and electrical). Coordination shall be accomplished prior to, and shall be reflected in, the submittal of shop drawings for approval. Any modifications or revisions required by other trades as a result of the use of equipment other than the basis of design shall be made at no additional cost.

1.7 EXAMINATION OF EXISTING PREMISES

A. Prior to the ordering or purchasing of any equipment or materials or the layout or installation of any work, the Contractor shall examine the premises and verify any and all of the existing conditions under which he will be obliged to operate, or that will in any manner affect the work under this Contract. No allowance will be made subsequently in behalf of the Contractor.

1.8 PAINTING

A. All piping exposed to public sight such as standpipe and drain piping exposed to exterior or moisture conditions, shall be primed and painted with two coats of an enamel-based paint. The color shall be as directed by the Architect.
B. Contractor shall touch-up to match original finish any equipment scratched in shipment or installation.

1.9 TRANSPORTATION, DELIVERY, STORAGE AND PROTECTION

A. The Contractor shall provide and pay for all transportation, delivery, and storage required for all equipment and materials. Upon receipt of all equipment and materials, they shall be properly stored in their original shipping container to protect them from vandalism, theft, the elements, and other harm or damage. Any equipment or materials received in a damaged condition, or damaged after receipt, shall not be installed. Only new undamaged equipment in first-class operating condition shall be installed.

B. All equipment and piping shall be protected to prevent entrance of foreign matter and debris by covering exposed openings during construction.

C. The Contractor shall closely coordinate the ordering and delivery of all mechanical equipment with other trades to assure that equipment will be delivered in time to be installed in the building without requiring special or temporary access or building modifications. Certain equipment may have to be installed prior to the erection of the building walls or roofs.

1.10 GUARANTY

A. All fire protection work described in the Contract Documents shall be guaranteed for a period of one (1) year from the date of final acceptance. This guaranty shall apply to all equipment, materials and workmanship. During the guaranty period, all defects shall be corrected in an acceptable manner, consistent with the quality of materials and workmanship of original construction, at no expense to the Owner.

1.11 SHOP DRAWINGS

A. It is the responsibility of the Contractor to coordinate the design with the work of all other disciplines so as to avoid conflicts. Where necessary piping shall be offset around ducts, structural members or other obstructions, while maintaining effective coverage, drains shall be provided per NFPA requirements.

B. Review of the Drawings and hydraulic calculations by Jordan & Skala Engineers, Inc. (JSE) is for coordination with the design concept for the project, and for assurance that they have been prepared in a timely manner. JSE is entitled to rely on the technical sufficiency and timely delivery of these documents, as well as on the computations performed by the subcontractor. JSE shall not be required to review or verify those computations or designs for compliance with applicable laws, statutes, ordinances, building codes, and rules and regulations.

C. All required submittal data other than fire protection shop drawings shall be transmitted simultaneously in hard ring binders with the associated specification section and the item submitted clearly identified. Partial submittals will be returned without review unless previously agreed to by the Engineer.

D. All fire protection drawing submittals shall be at 1/8" scale as a minimum. All submittals shall be in printed bond format only; submittals of multiple prints will be returned without review. JSE will return the original review markup with one (1) scan copy for the
The Contractor shall provide an itemized listing which indicates the horsepower and voltage of each piece of equipment that requires electrical service. The itemized list is to be located at the front of the bound submittal and is to be signed by the project managers of the Contractor, Electrical Contractor and General Contractor to ensure coordination of the electrical requirements for the project. Review of the equipment submittal will not begin until the electrical coordination document is provided.

Fire Protection shop drawings shall include all data required by NFPA Section 13. Shop drawing plans shall indicate all lights, grilles, soffits, alarms, speakers and other ceiling components, as well as hydraulic node points, to ensure coordination. Substitutions or alterations to the design included in the Contract Documents shall be clearly stated on the shop drawing submittal. The Contractor shall submit shop drawings to and secure approval of the Owner’s Underwriter, local authority and/or state authorities prior to submission to the Engineer. The Contractor shall not commence work, purchase, or provide any materials to the job site without obtaining shop drawing approval. Shop drawings shall include copies of all hydraulic calculations providing design densities, where applicable. In addition, shop drawings submittals shall include printed catalog specifications and data sheets for all of the following as applicable:

1. Fire department valves
2. Sprinkler heads and accessories
3. Siamese Fire Department connection
4. Fire valve cabinets
5. Test header
6. Backflow preventer
7. Cutting oil indicating compatibility with the CPVC sprinkler piping

A letter signed by an officer of the Contractor’s company shall be included in the submittal book that states the following items meet or exceed the requirements of the specifications:

1. Pipe and fittings
2. Valves
3. Pipe supports
4. Pipe accessories
5. Pipe labels and valve tags
6. Flow switches
7. Tamper switches

All design drawings and calculations prepared by the Contractor shall bear the seal of a registered professional or fire protection engineer or NICET Level IV certification licensed in the state of the project or equivalent fire sprinkler contractor’s certificate seal.

Included with submittals of plumbing equipment requiring electrical connections shall be a written statement confirming coordination of voltage requirements, bearing the names and signatures of the plumbing and electrical contractors. A photocopied reproduction of the below statement is acceptable.
VOLTAGE COORDINATION STATEMENT

This statement is to confirm that the voltages of the equipment provided under this specification have been coordinated with the electrical drawings, as well as with the electrical contractor.

Fire Protection Contractor: ________________________________
Project Manager Name: ________________________________
Project Manager Signature/Date: __________________________

Electrical Contractor: ________________________________
Project Manager Name: ________________________________
Project Manager Signature/Date: __________________________

1.12 AS-BUILT DRAWINGS

A. The Contractor shall maintain a record set of drawings indicating all changes in the work from that shown in the Contract Documents. Prior to final acceptance by the Owner, the Contractor shall assemble the complete set of as-built drawings that accurately reflects all changes to indicate actual final construction. All concealed piping shall be dimensionally located from at least two (2) column lines or major building structure elements. Drawings shall be a minimum of 1/8" scale.

B. The original set of “as-built” drawings shall be scanned and transmitted to the Architect in CD format along with the original “as-built” documents.

1.13 OPERATING AND MAINTENANCE INSTRUCTIONS

A. Prior to final acceptance by the Owner, the Contractor shall provide three (3) copies of an Operations and Maintenance Manual, Bound, indexed, and titled in three-ring, loose-leaf binders. These manuals shall each contain the following:

1. Clear and concise instructions for operation, maintenance, adjustment, lubrication, wiring diagrams and trouble-shooting data for all mechanical equipment. This information shall be prepared by the manufacturer for particular size and model of equipment furnished.
2. Parts list of all parts for equipment, with catalog numbers and other data necessary for ordering of replacement parts.
3. Provide a competent manufacturer’s service engineer for a minimum of two (2) days to instruct the operating personnel including the interpretation of all equipment diagrams. A diary of the training sessions shall be made by the instructing manufacturer’s service engineer and witnessed by the Owner’s representative and shall be included in the as-built submittal.
4. Copies of all approved equipment shop drawings, sprinkler layout drawings, hydraulic calculations and as-built plans shall be submitted with the Operation and Maintenance manual.
5. Index shall include type of equipment, manufacturer, and local representative with address and phone number.
PART 2 - PRODUCTS

2.1 FIRE PROTECTION SYSTEM MATERIALS

A. All materials, pipe, valves and equipment furnished under this section shall be new and approved by NFPA, Underwriters Laboratories Inc. (UL), Factory Mutual (FM) and American Water Works Association (AWWA) where applicable.

B. The proposal submitted shall include all materials and equipment as specified or shown on the Drawings. Proposed substitutions with difference in price, if any, shall be listed separately on the bid form at the time of submittal.

C. Required materials not covered by the detailed specifications shall be of a suitable class, grade and type and shall be subject to the approval of the Engineer. Where two or more units of the same class or type of equipment are required, these units shall be the products of a single manufacturer.

2.2 PIPE, JOINTS AND FITTINGS

A. Underground Piping

1. Class 50 and 51 ductile iron pipe, bituminous coated outside, cement lined interior, ANSI A21.51 and A21.4

   a. Push-on or mechanical joints with neoprene gasket, 250 psi rating, ANSI A21.11
   b. Ductile iron mechanical joint fittings with neoprene gasket, bituminous coated outside, cement lined interior, 250 psi rating, ANSI A21.10
   c. Ductile iron flanged joints for all piping in vaults, red rubber gaskets, 250 psi rating, ANSI A21.15. Cadmium plated heavy hex machine bolts and nuts with bituminous coating field applied.

2. Class 150 polyvinyl chloride (PVC) DR 18 pressure pipe, NSF and Factory Mutual approved, AWWA C900

   a. Push-on or mechanical joints with neoprene gasket, ASTM D3139 and ANSI A21.11
   b. Ductile iron mechanical joint fittings with neoprene gasket, bituminous coated outside, cement lined interior, 250 psi rating, ANSI A21.10
   c. Ductile iron flanged joints for all piping in vaults, red rubber gaskets, 250 psi rating, ANSI A21.15. Cadmium plated heavy hex machine bolts and nuts with bituminous coating field applied.

3. Underground piping and installation shall be in accordance with the Insurance Underwriter’s requirements and NFPA-24 and shall be installed with a minimum of 2'-6" of cover.

   a. Trenching conditions for ductile iron pipe shall be Type 1 laying condition, ANSI A21.50.
   b. Trenching conditions for PVC pipe shall be Class C bedding, ASCE Manual #37, and manufacturer’s recommendations.
B. Aboveground Piping

1. Schedule 40 welded or seamless steel pipe, ASTM A53 and A135, and A795. In accordance with NFPA 13, piping with threaded joints 6" and smaller shall be Schedule 40, piping 8" and larger may be Schedule 30 minimum. For welded or roll-grooved joints, wall thickness shall be Schedule 5 minimum for piping 5" and smaller, 0.134" for 6" pipe, and 0.188 for 8" and 10" pipe. Schedule 80 pipe shall be used when working pressures exceed 300 psi.
   a. Class 125 and 250 cast iron threaded fittings, ANSI B16.4
   b. Class 150 and 300 malleable iron threaded fittings, ANSI B16.3
   c. Class 125 and 250 cast iron flanged fittings, ANSI B16.1
   d. Schedule 40, 150 psi, forged steel butt welded fittings, ANSI B16.9
   e. Grooved mechanical couplings and fittings with EPDM gasket, malleable iron or ductile iron, 800 psi minimum rating ASTM A47 and A536, UL Listed, FM Approved
   f. All cutting oils, thread sealants and other products must be compatible with the CPVC piping installed.

2. Schedule 10 minimum lightwall welded or seamless steel pipe with corrosion resistant coating, CRR Value of 1 minimum, ASTM A53 and A135
   a. Grooved mechanical couplings and fittings with EPDM gasket, malleable iron or ductile iron, 800 psi minimum rating ASTM A47 and A536, UL Listed, FM Approved
   b. Lightwall, 150 psi, butt weld fittings, ANSI B16.9

3. Chlorinated polyvinyl chloride (CPVC) pipe, ASTM D1784 and F442, UL Listed, plenum rated
   a. Schedule 80 chlorinated polyvinyl chloride (CPVC), solvent welded socket, ASTM F439, UL Listed, plenum rated
   b. Schedule 80 chlorinated polyvinyl chloride (CPVC), threaded, ASTM F437, UL Listed, plenum rated
   c. CPVC piping is not to be installed in areas of exposed construction. Provide steel pipe and fittings in all areas where piping is exposed.

4. Dry Systems
   a. Schedule 40 welded or seamless internally and externally galvanized steel pipe, ASTM A53 and A135.
   b. Schedule 10 minimum lightwall welded or seamless steel pipe with corrosion resistant coating, CRR Value of 1 minimum, ASTM A53 and A135 may be considered as a deductive alternate.
   c. Class 150 and 300 internally and externally galvanized malleable iron threaded fittings, ANSI B.16.3
   d. Grooved mechanical couplings and fittings with EPDM gasket, galvanized malleable iron or ductile iron, 800 psi minimum rating, ASTM A47 and A536, UL Listed, FM Approved
   e. Provide chromium plated zinc or other approved corrosion prohibitant at all non-galvanized pipe threads, bolts and other areas to maintain the integrity of the galvanized system.
5. Flexible stainless steel piping connection, UL Listed and FM Approved, 1” NPS corrugated braided stainless steel hose assembly, 7” maximum bend radius installation, 175 psi rating
   a. Viking Flexible Sprinkler Connection (FPSJ-1000), Victaulic I-Aquaflex series or Flexhead Series 2000

C. All interior sprinkler piping shall meet the requirements of applicable sections of NFPA, and the Owner’s Underwriter. All pipe, fittings, valves, and sprinkler system components shall be rated for working pressures as required by system design.

D. All pipe, supports and hanger assemblies shall be in accordance with NFPA-13 and shall be UL Listed or FM Approved.

E. All sprinkler hangers and support rods installed in areas exposed to exterior conditions, including parking decks, are to be fully galvanized or painted with two coats of Adsil Microguard corrosion inhibitor.

2.3 VALVES AND ACCESSORIES

A. Valves shall be installed where shown on the Drawings and elsewhere as required by codes or standards. All valves shall be UL Listed or FM Approved for fire protection service. All valves shall be provided with remote alarm tamper switches compatible with the Owner’s central alarm system to monitor valve tampering. All switches and systems shall be Class B supervised. Provide 250 and 300 psi rated components at all locations as required by system pressure.

1. Gate Valves
   a. 2-1/2" and larger, Class 175 or 300, iron body, bronze mounted, solid wedge, outside screw and yoke, flanged ends, Stockham G-634 or F-670, listed for fire service
   b. 2" and smaller, Class 175, bronze body and trim, solid wedge, outside screw and yoke, threaded ends, Stockham B-133
   c. Provide UL Listed pressure regulating valves at all locations required due to system pressure. Valves shall be Potter Roemer Series 4000 or approved equal.

2. Butterfly Valves
   a. 4" and larger, Class 175, iron body, aluminum bronze disc, wafer or lug style, EPDM gasket, Stockham LG-52U
   b. 2" and smaller, Class 175, bronze body, stainless steel disc threaded ends, Milwaukee BB-FP

3. Check Valves
   a. 2-1/2" and larger, Class 125, iron body, bronze disc, flanged or threaded ends, Stockham G-931 and G-927
   b. 2-1/2" and larger, Class 125, iron body, bronze trim, flanged ends, Milwaukee 1800 series, flanged, UL Listed for fire service
   c. 4" and larger, Mission fig. U-12 HMP, wafer body, UL Listed for fire service
4. Backflow Preventers
   a. Double check assembly shall be a complete assembly with two (2) independently operating check valves mounted in a common body, two (2) gate valves and four (4) test cocks, designed for horizontal installation. All valves shall be provided with tamper switches. The complete assembly shall be UL Listed, FM Approved, designed to specifications and/or requirements of USC, CCCL, AWWA and ASSE and shall be sized for the full fire flow demand at a maximum of 6 psi pressure drop.
      1) Double check backflow preventer shall be Ames Maxim 200 Series, Watts No. 709, Hersey No. 2 or approved equal.
      2) Double detector check backflow preventers shall be provided where required by local authorities; assembly shall be Ames Maxim 300 Series, Watts No. 770, Hersey Model DDC II or approved equal.

5. Fire Department Valves
   a. Fire Department valve shall be 2-1/2" cast brass body, 300 lb. rating, female N.P.T. inlet, male hose thread outlet, complete with cap and chain, brass finish. Valve shall be Potter Roemer Fig. 4065 or approved equal.
   b. Provide UL Listed pressure regulating valves at all locations as required by system pressure. Valve shall be Potter Roemer 4000 Series or approved equal.

6. Floor Control Valve
   a. The floor control valve assembly shall be provided with a valve with supervisory switch. A check valve, pressure gauge, water flow switch and test connection with drain shall be provided downstream. The installation shall be per NFPA 13 requirements.
   b. Provide UL Listed pressure regulating valves at all locations as required by system pressure. Valve shall be Potter Roemer 4000 Series or approved equal.

7. Siamese Fire Department Connection
   a. Fire department connection shall be 2-way exposed Siamese type, 2-1/2" x 2-1/2" x 4" size, cast brass body, polished chrome finish for all exposed surfaces, cast brass escutcheon, and brass female hose inlets having individual clapper valves, plugs, and chains. Assembly shall be located with the center line of the hose inlets at 2'-6" above adjacent grade. Inlet threading shall be National Standard or same as municipal fire department, as required. Assembly shall be UL Listed, FM Approved. Wall Mounted: Potter Roemer 5710 series or approved equal.
   b. Free Standing: Potter Roemer 5760 series or approved equal.

8. Fire Valve Cabinet
   a. Cabinet shall be 20-gauge steel with polyester coating, recessed with flush full metal hinged door with cam catch and integral shelf for fire extinguisher. Cabinet shall be Potter-Roemer 1870 series or approved equal.
9. Roof Manifold
   a. Wall mount manifold to be three outlet horizontal configuration, cast brass body with threaded 2-1/2" male outlets complete with valves, chains and caps, rough brass finish. Provide accessible indicating type shut off valve with supervisory switch (normally closed) and automatic ball drip to roof. Roof manifold to be Potter-Roemer 5880 series or approved equal.

2.4 AUTOMATIC SPRINKLER SYSTEM MATERIALS

A. The underground fire protection service shall be provided with thrust blocks and rods and clamps at the service entry.

B. Automatic sprinklers shall be provided as follows:

1. Public Spaces with Gypsum Ceilings
   a. Fully concealed type sprinklers, glass element, or fusible link style, quick response sprinklers shall be provided in all areas with gypsum ceilings unless otherwise noted. Temperature rating of sprinklers shall be 155 – 165 degrees. Ceiling coverplate shall be factory painted to match the adjacent ceiling color; submit painted sample to the Architect for approval. Sprinkler to be Viking Horizon Mirage concealed sprinkler or approved equal.
   b. Small frame glass element, semi-recessed, quick response pendent sprinklers shall be provided in all areas with lay-in ceilings unless otherwise noted. Temperature rating of sprinklers shall be 155 – 165 degrees. Sprinkler and escutcheon to be white finish. Sprinkler to be Viking Microfast Model M series with Model E-1 escutcheon.

2. Public and Back-of-House Spaces with Lay-in Ceilings
   a. Small frame glass element, semi-recessed, quick response pendent sprinklers shall be provided in all areas with lay-in ceilings unless otherwise noted. Temperature rating of sprinklers shall be 155 – 165 degrees. Sprinkler and escutcheon to be white painted finish. Sprinkler to be Viking Microfast Model M series with Model E-1 escutcheon.

3. Back-of-House Spaces and Unfinished Spaces with no Ceiling
   a. Quick response upright pendent sprinklers shall be provided in all areas with no ceiling. Temperature rating is to be 165 degrees unless conditions require higher temperature. Finish of sprinkler to be rough brass. Sprinkler to be Viking Microfast Model M.

4. Exterior Overhangs
   a. Standard response chrome plated dry horizontal sidewall or upright sprinklers are to be provided. Barrel length shall be a minimum of 12". Sprinkler and escutcheon shall have UL Listed polyester or Teflon corrosion protection at exterior overhangs and rough brass finish at elevator shafts. Sprinkler shall be Viking Model M.
5. Alternate acceptable manufacturers with equivalent sprinklers are Automatic, Anvil International, Gem and Reliable.

6. Sprinkler guards shall be installed on all sprinklers 7'-0" or less above floor.

7. Provide sprinklers at the highest and lowest level of all stairwells.

8. Provide sprinklers in electrical rooms and elevator machine rooms unless specifically prohibited by local authorities; the sprinkler supply to each space shall be provided with a supervised valve and flow switch. Coordinate the intermediate temperature rating of the sprinkler head in all elevator machine rooms with the electrical contractor to ensure sprinkler operation will not occur prior to activation of the heat detector and the shunt trip circuit breaker.

9. Sidewall sprinklers shall be installed in all electrical rooms, electrical closets and elevator machine rooms where adequate coverage is provided. Upright sprinklers shall be installed in these spaces when coverage limitations of the sidewall sprinklers are exceeded. Piping shall not be installed above any electrical equipment, switchboard or panelboard. Piping shall offset around surface mounted light fixtures where possible, provide a minimum of 6” clearance below the bottom of the light fixtures at all locations.

10. The property is to be fully sprinklered throughout per the requirements of NFPA unless specifically noted otherwise. Elimination of sprinklers in electrical rooms, elevator shafts and elevator machine rooms shall be clearly indicated on the shop drawing submittal noting the exception applied for the deletion of sprinklers in these spaces.

11. The Contractor shall furnish and install a cabinet located in the fire service entry room with the quantity of each type of sprinklers and wrenches as required by NFPA 13:

   a. facilities with less than 300 sprinklers – 6 minimum
   b. facilities with 300 to 1000 sprinklers – 12 minimum
   c. facilities with over 1000 sprinklers – 24 minimum

12. The Contractor shall provide and place suitable signs indicating the purpose of each control valve, test connection, main and auxiliary drain, etc., as required.

13. Provide higher intermediate temperature rated sprinklers in all areas required due to service conditions and as required by NFPA 13.

2.5 DRY SPRINKLER SYSTEMS

A. The Contractor shall furnish and install all specialty valves, pipe and equipment as required for the systems. The systems shall be complete with dry pipe valve, air compressor, accelerator, maintenance pressure compressor and associated trim and wired for interconnection to all required accessories, heat/smoke detectors, pressure switches, etc. as required.

B. Pad-mounted storage tank/air compressors assemblies and riser-mounted air compressors shall be sized, furnished and installed as an integral part of the dry pipe sprinkler system and shall meet all requirements of NFPA.

C. Should wet pipe systems in non-heated spaces be substituted for dry sprinkler systems as designed, the contractor is responsible for adding heat tracing, including all required electrical, insulation, supervision, etc. Substitutions or alterations to the original design shall be clearly stated on shop drawing submittals.
2.6 HEAT TRACING CABLE FOR FREEZE PROTECTION OF PIPING

A. Provide pipe insulation with waterproof covering and listed electric heat tracing cable on all fire protection standpipe, cross main, feed main and branch piping located within areas exposed to temperatures below 40°F and as indicated on the Contract Documents.

B. Provide a complete UL Listed or FM Approved system of self-regulating heating cables, pipe insulation, controllers and components to maintain exposed fire protection piping at or above 40°F.

C. Electric heat cable shall be installed linearly along the bottom of the pipe and allowance shall be made for all fittings, valves, pipe supports, etc. Cable shall be installed prior to insulation of the piping system.

D. Electric cable shall be capable of maintaining a minimum water temperature of 40 degrees F at an ambient air temperature of 0 degrees F.

E. The electric cable shall be the self-regulating type that responds to varying localized temperature conditions by varying the heat output along its length. This shall be accomplished by a self-regulating core which varies its resistance continuously with changes in temperature. A constant wattage heater is not acceptable.

F. Provide single or multiple circuit digital controller as required by the project, connected to and monitored by the building BAS system. All enclosures shall be NEMA 4X.

G. All heat tracing systems shall be supervised as required by NFPA 13.

H. Provide a thermostat control, which de-energizes the heating cable when the ambient air temperature is above 40 degrees F (adjustable). While energized, the heat cable shall be entirely self-regulating.

I. Provide all power connection hardware, splices, end seals, etc., to accomplish installation. All hardware shall be by the same manufacturer as the cable.

J. Electric heating cable and accessories shall be UL Listed. Electric heating cable shall conform to all requirements of Division 16.

K. Electric heating cable shall be Raychem XL or Engineer approved equal.

L. All piping shall be insulated with 1" thick fiberglass insulation with factory applied all-service jacket. Piping exposed to exterior conditions shall be provided with 0.016" minimum corrugated aluminum metal jacketing with bands on 3'-0" centers.

M. Heating-cable circuit shall be protected by a ground-fault device for equipment protection. This requirement is in accordance with section 427-22 of the NEC-2005.

N. All heating cable components shall be UL Listed, CSA Certified, or FM Approved for use as part of the system to provide pipe freeze protection. Component enclosures shall be rated NEMA 4X to prevent water ingress and corrosion. Installation shall not require the installing contractor to cut into the heating-cable core to expose the bus wires. Connection systems that require the installing contractor to strip the bus wires or that use crimps or terminal blocks, shall not be acceptable.
2.7 TESTS AND DRAINS

A. The Contractor shall provide test connections as required and as indicated on the Drawings. Inspector's test connections shall be fitted with sight glasses and the discharge of the drain riser shall be terminated above an adjacent hub drain with an air gap fitting. All tests shall have approved sight test assemblies as required by NFPA.

2.8 ELECTRIC MOTORS AND RELAYS

A. Design, type and ratings of electric motors shall comply with the National Electrical Code, NEMA and Underwriters Laboratories Inc.

B. Unless otherwise noted, or required for special applications, motors shall be equipped with sealed ball bearings.

C. All motors to be mounted on equipment supplied under this section shall be as manufactured by General Electric, Westinghouse, or Louis Allis.

2.9 PIPING AND EQUIPMENT IDENTIFICATION

A. A marker showing the service and an arrow indicating the direction of flow shall be applied on the following equipment installed under this section of the Specifications:

1. All above ground fire protection standpipe and sprinkler piping
2. All above ground sprinkler drainage piping

B. Piping identification shall be applied in areas of exposed construction and in areas with accessible or lay-in ceilings. The piping shall be labeled at each valve, wall and floor penetrations (both sides) and at connections to equipment. In addition, straight runs of piping shall be labeled at intervals not greater than 25 feet.

C. Equipment and component parts thereof shall bear manufacturer’s nameplate, giving manufacturer’s name, size, type model number or serial number, and electrical characteristics, to facilitate maintenance and replacements. Nameplates of distributors or subcontractors are not acceptable. Electrical equipment shall be UL Listed as applicable.

D. The letter size and background color shall conform to the Identification of Pipe System ANSI A-13-1. The vinyl plastic markers shall be as manufactured by Seton Name-Plate Company, W.H. Brady Company, or Westline Products.

E. All valves shall have a 1-1/2” diameter laminate plastic tag, engraved, black and white marking and a brass hook for attaching to valve stem. Tags shall have letters as large as practical, the number of the valve and the service such as indicated on the “Legend.” The numbers of service shall be consecutive. Tags shall be similar to Seton 2961.

F. All valves on pumps shall be similar to the valve tags specified above, except they shall be 2-1/2” in diameter, black with white number 2” high for attaching to valve stem by means of brass hook or small solid link brass chain. Tags shall be similar to Seton 2961-25.

G. These numbers shall correspond with numbers indicated for valves and controls on two printed detailed lists and locational diagrams. These printed lists and locational diagrams
shall state the numbers and locations of each valve and control and the section which it controls.

H. The printed lists shall be prepared by Wrico pencil lettering or typed and shall be framed under glass, and mounted as directed by the Owner.

PART 3 - EXECUTION

3.1 INSTALLATION

A. The Drawings are diagrammatic and the final arrangement of the work shall suit field conditions, the characteristics of the materials used and coordination with all other disciplines and the building components and finishes. Verify all dimensions in the field. Access and clearances must be provided and maintained for the proper operation, maintenance service and repair of the work.

B. No sprinklers are to be installed prior to the building being completely sealed in from external moisture and conditions.

C. All standpipe, sprinkler and drain piping exposed to sight in stairwells is to be painted with two coats of an epoxy based paint, color to be selected by the Architect.

D. All equipment and materials shall be installed according to manufacturer’s recommendations and shall meet the requirements of NFPA and the Owner’s Insurance Underwriter.

E. All sprinklers in spaces visible to public view shall be located symmetrically in relation to ceiling design elements, lighting fixtures, speakers, diffusers, etc. All ceiling components are to be indicated on the submittal drawings as noted previously to ensure coordination with all ceiling elements and devices. Piping to sprinklers in these areas is to be provided with arm-overs or flexible sprinkler drops to allow for exact placement of sprinklers.

F. Sprinklers shall be installed at the centerpoint of all 2’ x 2’ lay-in ceiling tiles, and at the centerpoint or 1’ from the ends of 4’ x 2’ ceiling tiles.

G. Where pipe is installed above suspended ceilings, it shall be located in the clear space above the suspended ceiling and the pendent sprinklers shall be located to clear the ceiling supporting grid system, the ceiling mounted fixtures, and air conditioning ducts and outlets.

H. The Contractor shall install additional pendent sprinkler heads under all ductwork or other obstructions which are over 48” wide in accordance with NFPA-13 in areas of exposed construction.

I. All sprinklers located in areas that are to be painted shall be protected prior to painting.

J. Provide a pressure gauge at the top level of all standpipes.

K. Where wet fire protection standpipe, cross main, feed main and branch piping are located within areas exposed to temperatures below 40° F, listed electric heat tracing and pipe insulation shall be installed in accordance with the requirements of Section 2.6 – Heat Tracing Cable for Freeze Protection of Piping.
3.2 PREPARATION
A. Arrangements shall be made to have the openings, inserts, sleeves, blockouts, and such other incidentals set in place ahead of the construction work, where practical, to eliminate the need of cutting and patching. If coring becomes necessary for installation of the work, it shall be done under this section. All holes shall be neatly patched and finished to match the adjoining work in a manner approved by the Architect. All coring shall be performed in a manner not to weaken the structural parts and the manner and method shall be submitted to the Structural Engineer for approval.

3.3 SLEEVES AND ESCUTCHEONS
A. The Contractor shall furnish and set pipe sleeves and inserts for all work under this section and shall be responsible for their proper and permanent location. In the event that failure to do so requires cutting and patching, the remedial work shall be the responsibility of the Contractor.

B. All pipes passing through floors, walls or partitions shall be provided with sleeves having an internal diameter 1-1/2" (3/4" annular space) larger than the outside diameter of the pipe or insulation on covered lines, except as otherwise specified herein.

C. Sleeves for all pipes through walls, beams and partitions shall finish flush with the finish line of the walls, beams and partitions.

D. Sleeves for all piping shall extend 1/2" above finish floor, (except where under partitions, the sleeves shall be flush with the bottom of the partition) and after the installation of pipe shall be packed and made watertight with fire stopping sealant to maintain separations and fire ratings.

E. Where pipes pass under footings and through exterior walls, sleeves shall be of galvanized steel pipe and shall be not less than 4" larger than the pipe being sleeved. Sleeves shall be made watertight where passing through waterproofed surfaces, exterior wall, and floor slabs on grade. Waterproofing shall be done by means of a steel slip on welding flange, continuously welded at the center of the sleeve and shall be painted with one coat of bitumastic paint inside and outside. The space between sleeve and pipe shall be packed with oakum to within 2" of each face of the wall; (to within 2" of the top of sleeve at floors). The remaining space shall be packed and made watertight with a waterproof mastic. Mechanical expansion type rubber seals such as manufactured by Calpico Ind. and Thunderline Corporation are acceptable as alternate method of water proofing piping penetrations.

F. Sleeves through floors or interior masonry walls shall be of galvanized steel pipe or wrought iron pipe size except where located in concealed pipe spaces where they may be of 22 gauge galvanized sheet steel if fire rating is maintained.

G. Sleeves through interior masonry partitions shall be of 22-gauge galvanized sheet steel.

H. Sleeves for piping to receive insulation shall be large enough to allow continuous insulation through sleeves.

I. Spacing between or location of pipe sleeves in floor slabs, structural beams or structural walls shall be subject to the Structural Engineer’s approval.
J. Where pipes pass under load bearing footings they shall pass through a coated steel pipe sleeve as described above and extend past a 45 degree line out from the bottom of the load bearing structure. Concrete shall be used as backfill in the portions of trench within the 45 degree pressure line.

K. Escutcheons shall be provided around all exposed pipe passing through walls, partitions, ceilings and floors in finished spaces. Escutcheons shall be of sufficient outside diameter to cover the sleeve opening and shall fit snugly around the insulated or bare pipe and to the wall, partition, floor or ceiling.

3.4 WORKMANSHIP

A. All work shall be coordinated with the work to be performed or installed under other sections of these Specifications.

B. All work shall be executed in a workmanlike manner by workmen skilled in this type of work and shall present a neat appearance when completed.

C. Offsets shall be provided as required to avoid interference and conflicts with other work, to maximize headroom, or to improve the appearance of pipe runs. All pipe supports, structural members, hangers and other apparatus necessary to support firmly and substantially the various components of the systems shall be provided under this section.

D. Nameplates, catalog numbers and rating identifications shall be securely attached to equipment with screws or rivets. Adhesives or cements will not be permitted.

E. The subcontractor shall be responsible for the protection of the work from injury and shall protect all apparatus with suitable enclosures.

3.5 ERECTION AND INSTALLATION

A. Installation and workmanship requirements are specified hereinafter.

B. This subcontractor shall be responsible for the furnishing and installing of all support steel, hangers, rods, clamps, etc., to provide adequate support of all Fire Protection equipment specified herein. All support assemblies shall be UL Listed or FM Approved.

3.6 CLEANING OF SYSTEMS AND PREMISES

A. At all times, keep the premises clear of undue accumulation of rubbish.

B. On completion of the work, remove all rubbish and debris resulting from this Contract, and dispose of same.

C. All equipment shall be thoroughly cleaned and left in a satisfactory condition for proper operation at project completion. All equipment shall be partially or fully re-painted as required to provide an appearance of new equipment.

3.7 TESTS

A. Tests of all fire protection systems and equipment, underground and inside piping including alarm and detection devices shall be scheduled with one (1) week prior notification to a local representative of the Underwriter and the Architect. All tests and
test procedures shall be in accordance with the applicable NFPA standards. After completion of all tests, the “Contractor's Materials and Test Certificate” shall be submitted to the Architect.

B. The Contractor shall supply all materials, labor, utilities and power required for testing. Preliminary tests shall be performed to prove work is satisfactory prior to requesting a test inspection. Sectional tests shall be made before insulation or concealing any piping.

C. Repair all defects disclosed by tests or, if required by the Architect, replace defective work with new systems and materials at no additional cost to the Owner. Repairs to piping systems shall be made with new material. No caulking of screwed joints, cracks or holes will be accepted. Make tests in stages to facilitate work of others.

D. The Contractor shall be responsible for the repair and/or replacement cost installed and finishes damaged by leaks, tests and/or repair and replacement of his work at no additional expense to the Owner.

E. Prior to final acceptance by the Owner, submit the “Contractor’s Material and Test Certificates” indicating system compliance with all applicable sections of NFPA.

3.8 SUBCONTRACTOR’S WARRANTY

A. The Contractor shall warrant all equipment and the installation to function properly for a period of one year from date of final acceptance of the work.

B. Defects becoming apparent within the warranty period shall be repaired by the Contractor. In addition, all damages to installed work and finishes resulting from such defects shall be the responsibility of this Contractor either to repair or replace to equal the existing installation.

C. This warranty shall in no way obligate the Contractor to repair any and all damages resulting from accident or improper operation or care on the part of the Owner.
HEATING, VENTILATING AND AIR CONDITIONING  ELECTRIC WALL HEATERS
DIVISION 15  SECTION 15605

PART 1 - GENERAL

1.1 GENERAL REQUIREMENTS
A. All work specified herein shall be accomplished in accordance with the applicable requirements of Section 15000 - HVAC General.

1.2 WORK INCLUDED
A. Receipt, unloading, handling, proper storage and protection from damage of all materials.
B. Layout and coordination of work with other trades.
C. The work under this section shall include all labor, materials, accessories, services, and equipment necessary to furnish and install wall heaters complete as indicated on the Drawings and as specified herein.

PART 2 - PRODUCTS

2.1 WALL HEATERS
A. Unit shall be UL Listed, completely factory assembled, wired, tested and shipped as a single assembly. Capacity shall be as indicated on the Drawings.
B. Front grille shall be 16-gauge steel or aluminum finished in baked enamel or anodized with downflow discharge louvers.
C. Element shall consist of helically coiled nickel chromium alloy resistance wire enclosed in corrosion resistant sheaths.
D. Controls shall include fan delay switch, built-in thermostat, automatic reset thermal overload switch and a non-fused disconnect power switch.
E. Unit shall be designed to either recess into the wall or for surface mounting as scheduled, and shall include all mounting accessories.
F. Unit shall be Q-Mark, Markel or approved equal.

PART 3 - EXECUTION

3.1 INSTALLATION
A. All units shall be installed in strict accordance with the manufacturer’s recommendations.

END OF SECTION
UNITARY EXHAUST AND HEATING, VENTILATING AND AIR CONDITIONING SUPPLY FANS AND VENTILATORS
DIVISION 15
SECTION 15830

PART 1 - GENERAL

1.1 DESCRIPTION

A. Refer to specification section 15000 - HVAC General, all of which applies to work described in this section as if written in full herein.

B. Furnish and install all unitary exhaust and supply fans and ventilators of the size, type, capacity and characteristics as shown on the equipment schedules and herein described.

C. Acceptable manufacturers include only those whose products have been in satisfactory use in similar service for not less than five (5) years.

D. Electrical Standards: Provide electrical motors and products which have been listed and labeled by Underwriters Laboratories Inc. and comply with NEMA Standards.

E. Certification, Fan Performance: Provide fans whose performance is certified by AMCA under the specified conditions.

PART 2 - PRODUCTS

2.1 CENTRIFUGAL AND AXIAL FANS AND VENTILATORS

A. All units shall be rigidly constructed of materials suitable for the intended service and shall be installed with all accessories listed on the Drawings.

B. All roof mounted units shall be installed on factory supplied 12-inch high (minimum) insulated roof curbs of the proper type, size and construction for proper mounting. Curbs shall account for all roof slopes and pitches so that the unit is installed level. Units shall be anchored to curbs by a minimum of two lag screws of adequate size on each side. Curbs shall be constructed of galvanized steel, except when the project is located within 5 miles of a sea coast they shall be of aluminum construction.

C. Outdoor fans shall be completely weatherproof for outdoor installation and shall contain internal vibration isolation to assure smooth and quiet performance.

D. Fan wheels and blades shall be constructed of aluminum and shall be statically and dynamically balanced at the factory.

2.2 CEILING-CENTRIFUGAL AND CABINET FANS

A. Units shall be direct-drive type with back-draft damper, acoustically insulated cabinets and speed controller.

2.3 EXHAUST FANS SERVING KITCHEN HOODS

A. Grease handling exhaust fans shall carry a UL 762 Listing and shall be provided with all accessories/features required to meet that listing.

B. Grease exhaust fans shall discharge a minimum of 42" above the finished roof.
PART 3 - EXECUTION

3.1 GENERAL

A. All units shall be installed in accordance with manufacturer’s recommendations and as shown on the Drawings.

B. Ceiling-centrifugal and cabinet fans shall be supported from structural members and shall not rest on the ceiling, on lights or on structural members.

C. Units shall be interlocked and controlled as indicated on the Drawings.

D. Ceiling-mounted units shall be installed with ceiling grilles flush with the ceiling.

E. Curb-mounted fans shall be secured to the roof curb with lag screws in each hole in the fan curb cap.

F. Electrical connection to the fan motor shall be made through the roof opening inside the roof curb.

END OF SECTION
PART 1 - GENERAL

1.1 GENERAL REQUIREMENTS

A. All work specified herein shall be accomplished in accordance with the applicable requirements of Section 15000 - HVAC General.

1.2 WORK INCLUDED

A. Receipt, unloading, handling, proper storage and protection from damage of all materials.

B. Layout and coordination of work with other trades.

C. The work included under this section shall include all labor, materials, accessories, services and equipment necessary to furnish and install curbs complete as indicated on the Drawings and as specified herein.

PART 2 - PRODUCTS

2.1 GENERAL

A. Prefabricated curbs for HVAC equipment located on the roof shall be manufactured by Custom Curb, Inc., Pate, Thycurb, Roof Products and Systems, Inc., or approved equal.

2.2 ROOF CURBS

A. Curbs shall be Series CRC-3 fabricated to match any roof slope and have a minimum height of 16". Coordinate with the roof system used so that a minimum of 8" of the curb is above the finished roof for flashing purposes. The top of the curb shall be level and the slope of the roof shall be compensated for by the curb.

B. Curbs shall be a minimum of 18-gauge galvanized steel construction (or as deemed necessary by the curb manufacturer to support unit load) with fully mitered and welded corners and self-flashing without cant. The curb shall not sag more than 1" in 240" + or - when supporting the unit at the corners of curb only. The curb shall be internally reinforced with angle iron, factory insulated with 1-1/2", 3 lb. density fiberglass insulation, and shall be complete with factory installed pressure treated wood nailers. Coordinate sizes to match frames provided by others. When the project is located within 5 miles of a sea coast, curbs shall be of aluminum construction.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Installation shall be in strict accordance with the manufacturer’s printed instructions and as detailed on the Drawings. Curb manufacturer shall coordinate with HVAC and General Contractor.

END OF SECTION
PART 1 - GENERAL

1.1 SUMMARY

A. Work of this section includes labor, material, and equipment to provide 2-hour fire-resistant rated grease or air duct enclosure as a shaft alternative and a method for providing 0" clearances around commercial kitchen grease duct exhaust systems to combustible materials.

1.2 REFERENCES

A. Test standards and reports for evaluating and rating performance of fire-resistant shaft alternative enclosures and 0" clearance duct wrap systems:

1. Underwriters Laboratories Inc. (UL)
   a. UL 723, surface burning characteristics per ASTM E84: File R8418, December 11, 1992; File R9464; File R9063
   c. UL 1479, Through-Penetration 3-Hour Firestop Test, File R14229
   d. Underwriters Laboratories of Canada, ISO 6944-1985, 1- and 2-Hour Large Ventilation Duct Fire-Resistive Enclosure Test
   e. Underwriters Laboratories of Canada CAN4-S115-M85/UL1479, 1 and 2-Hour Through-Penetration Firestop Tests
   f. Fire Protection Equipment Directory, YYET, R14229
   g. Fire-Resistive Directory, Vol II, File R8418, CAJ7009
   h. Building Materials Directory, File R8418
   i. Building Materials Directory, AWNW, R9700
   j. Fire-Resistive Directory, Vol II, File R14229, CAJ7013, CAJ7015, CAJ7020, CAJ7022
   k. Underwriters Laboratories of Canada, ULC S102-M88, flammability


   a. E119, Standard Method of Fire Tests of Building Construction and Materials; 2-Hour Wall Panel Test, and 2-Hour External Total Engulfment Test
   b. E814, Standard Method of Fire Tests of Through-Penetration Fire Stops; 2-Hour Firestop Tests
   c. E136, Combustibility Test

3. BOCA Evaluation Services, Inc., Report No. 92-3
6. California State Fire Marshal, File No. 2440-1361:100
7. New York City Department of Buildings; MEA-417-92-M
9. US Department of Transportation (DOT)

   a. DOT-HM-144
   b. DOT-HM-175
1.3 SYSTEM DESCRIPTION

A. A lightweight, non-asbestos, high temperature inorganic ceramic fiber blanket totally encapsulated in foil/scrim having a service temperature range up to 2,300 degrees F. FireMaster® Duct Wrap is directly applied to commercial grease hood duct systems and air duct systems to allow a 0" clearance to combustible construction and to provide a 2-hour fire-resistant duct enclosure. FireMaster® Duct Wrap, in conjunction with CAJ7013, CAJ7015, CAJ7020, or CAJ7022 through penetration firestop system is an alternative to rigid shaft enclosures. FireMaster® Duct Wrap is applied in a continuous wrap from the point the duct enters a concealed space to its exit from a building.

B. Performance Requirements

1. 2-hour rated fire-resistant enclosure assembly, ASTM E119: Large scale Wall Panel Test and Total Engagement Test
2. 0" clearance to combustible, maximum allowable surface temperature on unexposed side, UL 1978
3. Class I interior finish materials, ASTM E84
4. Through-penetration protection systems for grease and air ducts, ASTM E814 and UL 1479
5. Non-Combustibility, ASTM E136

1.4 SUBMITTALS

A. Submit test reports substantiating performance requirements and code compliance along with manufacturer's installation instructions.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Deliver materials in original sealed containers or unopened packages, and clearly labeled with manufacturer’s name, product identification, and lot numbers.

B. Store materials out of weather and in an enclosed shelter.

PART 2 - PRODUCTS

2.1 MANUFACTURER

A. Fire-resistant FireMaster® Duct Wrap materials; manufactured by Thermal Ceramics, Augusta, Georgia 30903, distributed by 3M, St. Paul, MN and its authorized distributors.

2.2 MATERIALS

A. Fire-resistant duct wrap: FireMaster® Duct Wrap, 1.5" thick, 24" or 48" wide x 300" long rolls, foil encapsulated with logo identification. FireMaster® Duct Wrap Collar, 8" wide for air duct butt joint optional wrap method (see Section 3.2, B).

B. Tapes

1. High performance filament: Tape No. 898, 1" wide, manufactured by 3M Company, St. Paul, MN, or equal and approved
2. Aluminum foil tape: Minimum 3" wide to seal cut blanket edges

C. Banding Material

1. Carbon steel banding for 1-hour ratings; 3/4" wide x 0.015" thick minimum
2. 304 Stainless steel banding for 2-hour ratings; 3/4" wide x 0.015" thick minimum

D. Insulation Pins/Washers

1. Pins: 10-gauge, 4" to 5" long, copper coated steel; washers: 1.5" x 1.5" or 1.5" diameter galvanized steel speed clip

E. Through-Penetration Fire Stop Materials

1. Packing Material: Scrap pieces, FireMaster® Duct Wrap, 1.5" thick or 3 pcf mineral wool as packing material
2. 3M FB-2000+Silicone or FireMaster® Putty, ceramic fiber based sealant

F. Grease Duct Access Door

1. Steel angle opening frame
2. Access Cover, minimum 16-gauge
3. Insulation Pins
4. Speed Clips, minimum 1.5" x 1.5" or 1.5" diameter galvanized steel

G. Hardware

1. Threaded rods: 4" to 5" long, 1/4" diameter galvanized steel with 1/4" wing nuts and 1/4" metal washers
2. 4" long steel hollow tubing to fit threaded rods
3. 1/4" wing nuts

PART 3 - EXECUTION

3.1 PREPARATION

A. Remove dirt and dust, and clean surfaces of openings and items penetrating rated floors and rated walls.

3.2 INSTALLATION

A. Install FireMaster® Duct Wrap system in accordance with manufacturer’s instructions and referenced standards.

B. Install FireMaster® Duct Wrap in direct contact with the duct it encloses. Protect every portion of duct with no less than two (2) layers for grease duct applications and one (1) layer for 1-hour air duct enclosures and two (2) layers for 2-hour air duct enclosures. Overlap both perimeter and longitudinal joints minimum 3" per layer of material.

Air Duct Enclosure Optional Wrap: Follow same traditional wrap method with exception of utilizing a 3" perimeter overlap in conjunction with longitudinal butt joint wrap plus FireMaster® Duct Wrap Collar over exterior layer joints. Filament tape is used as
temporary hold on both layers until banding hardware is in place. Band exterior layer spaced minimum 10-1/2" on center. For duct widths greater than 24", weld insulation pins to bottom horizontal and outer vertical duct runs. Impale FireMaster® Duct Wrap over pins and secure with galvanized steel speed clips until banding is applied.

C. Locate grease duct access doors at horizontal cleanouts as required by local codes. Protect with three (3) layers of FireMaster® Duct Wrap, each layer overlapping previous by 1" on all sides and in accordance with manufacturer’s instructions.

D. Protect floor and wall penetrations with an approved through-penetration system having an F and T hourly rating not less than that of assembly penetrated and installed in accordance with manufacturer’s instructions and as follows:

1. **Grease Ducts - 1 or 2-Hour Enclosure:** Option A: Two (2) layers of FireMaster® Duct Wrap per manufacturer’s installation instructions, maintaining 3" transverse and longitudinal overlaps continuous through the penetration. Option B: Tightly butt FireMaster® Duct Wrap to the floor or wall on both sides of the assembly. Fill remaining annular space (3" maximum) between the wrapped duct (Option A) or bare steel duct (Option B) and periphery of the opening with 4-1/4" thickness of scrap FireMaster® Duct Wrap, or 4-1/4" 3 pcf mineral wool batt, firmly packed into opening. Apply 1/4" minimum 2000+ Silicone over packing material, within the annulus, flush with top surface of floor or both surfaces of wall.

2. **Air Ducts - 1-Hour Enclosure:** Option A: One (1) layer FireMaster® Duct Wrap per manufacturer’s installation instructions, maintaining 3" transverse and longitudinal overlaps or optional 3" perimeter overlap with longitudinal butt joints plus FireMaster® Duct Wrap Collar over exterior layer joints. Option B: Tightly butt FireMaster® Duct Wrap to the floor or wall on both sides of the assembly. Fill remaining annular space between the wrapped duct (Option A) or bare steel duct (Option B) and periphery of the opening with 4-1/4" thickness of scrap FireMaster® Duct Wrap, or 4-1/4", 3 pcf mineral wool batt firmly packed into opening. Apply 1/4" minimum 2000+ Silicone over packing material within the annulus, flush with top surface of floor or both surfaces of wall.

3. **Air Ducts: 2-Hour Enclosure:** Same as 1-hour air duct enclosure system except apply two (2) layers of FireMaster® Duct Wrap per manufacturer’s installation instructions.

### 3.3 REPAIR PROCEDURE

A. Repair damaged FireMaster® Duct Wrap in accordance with manufacturer’s instructions.

B. Remove damaged section. Apply a new section of same dimension. Place and fit ensuring same overlap that existed previously. Place banding around new FireMaster® Duct Wrap material and tension to sufficiently hold in place.

C. If damage has penetrated to interior layer, remove affected sections and reinstall as specified in section 3.2 – INSTALLATION of this specification.

END OF SECTION
PART 1 - GENERAL

1.1 DESCRIPTION

A. Refer to specification section 15000 - HVAC General, all of which applies to work described in this section as if written in full herein.

B. The work described by this section of the specifications consists of furnishing all materials, instruments, labor, and appurtenances to test, adjust and balance all of the HVAC systems furnished and installed under Division 15 of the specifications.

C. The TAB agency shall be a subcontractor of the General Contractor and shall not report to or be paid by the HVAC Contractor. The HVAC subcontractor shall be responsible to cooperate with and provide for the balancing subcontractor any and all materials, services, labor, etc. to facilitate completion of the balancing work.

1.2 QUALITY ASSURANCE

A. The TAB agency and its specialist shall be certified members of Associated Air Balance Council (AABC) or certified by the National Environmental Balance Bureau (NEBB) to perform TAB service for HVAC, and vibration and sound testing of equipment. The certification shall be maintained for the entire duration of duties specified herein. The TAB agency shall have been in business for at least the past five years and must be free of disciplinary action by either the AABC or the NEBB during that time.

B. All TAB technicians performing actual TAB work shall be experienced and must have done satisfactory work on a minimum of 3 projects comparable in size and complexity of this project and must be certified so by the TAB agency in writing.

C. The basic instrumentation shall be calibrated to accuracy requirements by its manufacturer, AABC or NEBB Procedural Standards for Testing, Adjusting and Balancing of Environmental Systems. Provide calibration history of the instruments to be used for test and balance purpose.

D. One or more of the applicable AABC, NEBB or SMACNA publications, supplemented by the ASHRAE Handbooks and requirements stated herein shall be the basis for planning, procedures, tolerances and reports. Final report shall cite the exact names of publications used as a basis or reference for the TAB work or reports.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Provide plastic plugs to seal holes drilled in ductwork for test purposes.

B. Provide for repair of insulation removed or damaged for TAB work to match installation.
PART 3 - EXECUTION

3.1 TAB PROCEDURES

A. TAB shall be performed in accordance with the requirements of the Standard under which the TAB agency is certified, either AABC or NEBB.

B. During TAB all related system components shall be in full operation. Fan and pump rotation, motor loads and equipment vibration shall be checked and corrected as necessary before proceeding with TAB. Set controls and/or block off parts of distribution systems to simulate design operation of variable volume air or water systems for test and balance work.

C. Adjustment of the temperature controls shall be coordinated by the TAB work specialist in conjunction with the Automatic Temperature Control Company's Engineer. Both shall cooperate to simulate a complete cycle for every system in every mode of operation (automatic, economizer, fire emergency, etc.).

D. Coordinate TAB procedures with any phased construction completion requirements for the project. Provide TAB reports for each phase of the project prior to partial final inspections of each phase of the project.

3.2 AIR SYSTEMS TAB

A. Systems shall be tested, adjusted and balanced so that air quantities and temperatures at outlets are as shown on the Contract Drawings and so that the distribution from supply outlets is uniform over the face of each outlet.

B. Direct reading velocity meters may be used for comparative adjustment of individual outlets, but air quantities in ducts having velocities of 1,000 feet per minute or greater shall be measured by means of pitot tubes and inclined gauge manometers. Instrument test opening enclosures shall be provided as required at the direction of the TAB agency.

C. Adjustments shall be made in such a manner that splitter and volume adjusters close to air outlets will have the least pressure drop consistent with volume requirements. Primary balancing shall be obtained by adjustment of the dampers at branch duct take-offs. Adjustable fan drives shall be used for making final adjustments of total air quantities. Additional dampers or other air volume adjusters required to accomplish the balancing and adjusting shall be furnished and installed as part of the HVAC work.

D. Artificially load air filters by partial blanking to produce air pressure drop of at least 90 percent of the design final pressure drop.

E. Check and readjust factory set minimum and maximum air terminal unit flow rates if necessary. Balance air distribution on full cooling maximum. Reset room thermostats and check operation from minimum to maximum cooling, to the heating mode, and back to cooling. Record and report the heating coil leaving air temperature when in the maximum heating mode.

F. Adjust fan speeds to provide design air flow. Adjust V-belt drives, including fixed pitch pulley requirements.
G. After completion of the testing, adjusting and balancing of the air systems, six (6) copies of a recognized complete set of reports showing the minimum following information shall be submitted to the Engineer for review:

1. Systems inspection narrative on equipment and installation for conformance with design
2. Duct Air Leakage Test Report
3. Systems Readiness Report
4. TAB report covering flow balance and adjustments, performance tests, vibration tests and sound tests. Required information:
   a. Location of each air outlet or inlet. This shall be presented in the form of a reduced size floor plan showing outlet number keyed to the outlet number in the report.
   b. Dimensions or size of each outlet or inlet
   c. Type and manufacturer of diffusers, grilles, registers. Indicate duty as supply, return, exhaust, etc.
   d. Cfm of air as indicated on the Drawings for each outlet or inlet with corresponding velocity
   e. Velocity of air as measured and corresponding cfm at which system has been balanced and adjusted, for each outlet or inlet
   f. Velocity of air measured and corresponding cfm, after each complete system has been balanced and adjusted, for each main branch or zone duct at the supply fan, the return fan and the exhaust fan, as the case may be
   g. After each complete system has been balanced and adjusted, the total cfm at fan discharge, the total return air to the apparatus, the total outside air to the apparatus, the total outside air to the apparatus, static pressure at fan outlet, total static pressure for apparatus, fan speed, motor amperage for each phase and voltage

5. Narrative of uncorrected installation deficiencies noted during TAB and applicable explanatory comments on test results that differ from design requirements

H. The above testing, adjusting and balancing shall be performed for the first season of the year, cooling season or heating season, which occurs at the completion of the building. Additional balancing and adjusting which may be required for the season of the year next following shall be performed as part of the work under this specification.

3.3 VIBRATION TESTING

A. Furnish instruments and perform vibration measurements for all rotating HVAC equipment of 1/2 horsepower and larger, including centrifugal/screw compressors, cooling towers, pumps, fans and motors.

B. Record initial measurements for each unit of equipment on test forms and submit a report to General Contractor. Where vibration readings exceed the allowable tolerance, the HVAC Contractor shall correct the problem and the TAB agency shall verify the corrections are done for final reporting.

3.4 SOUND TESTING

A. Perform and record required sound level measurements in approximately 15% of all rooms as designated by the General Contractor.
B. Take measurements with a calibrated sound level meter and octave band analyzer of the accuracy required by AABC or NEBB.

C. Where measure sound levels exceed specified levels, the installing contractor or equipment manufacturer shall take remedial action approved by the General Contractor and the necessary sound tests shall be repeated.

3.5 MARKING OF SETTINGS AND TEST PORTS

A. Following the approval of the final TAB Report, the setting of all HVAC adjustment devices including valves, splitters and dampers shall be permanently marked by the TAB Specialist so that adjustment can be restored if disturbed at any time. Style and colors used for markings shall be coordinated with the General Contractor.

B. The TAB Specialist shall permanently and legibly identify the location points of duct test ports. If the ductwork has exterior insulation, the identification shall be made on the exterior side of the insulation. All penetrations through ductwork and ductwork insulation shall be sealed to prevent air leaks and maintain integrity of vapor barrier.
PART 1 - GENERAL

1.1 GENERAL REQUIREMENTS

A. General Conditions: Refer to the General Conditions, the Supplementary General Conditions and the Special Conditions, all provisions of which apply to work under this section as if written in full herein.

B. The scope of work to be done under this section of the specifications shall include the furnishing of labor, material, equipment and tools required for the complete installation of systems for power, lighting, signals and all other work indicated on the drawings or as specified herein. A 100% operational building and electrical distribution system up to a connection point for Owner furnished equipment will be provided.

C. The drawings and specifications are complementary to each other and what is called for by one shall be as binding as if called for by both.

1.2 STANDARDS

A. All work shall conform to all ordinances and regulations of the City, County, State and/or other authorities having jurisdiction in accordance with the requirements of the following codes, standards and design guides:

1. The 2011 edition of the National Electrical Code (NFPA 70) with Georgia Amendments
2. The 2012 edition of the International Building Code with Georgia Amendments
4. The National Electrical Safety Code (ANSI C-2)
5. Regulations of the local utility company with respect to metering and service entrance
6. Local city and county ordinances governing electrical work
7. Americans with Disabilities Act (Public Law 101-336)

1.3 PERMITS

A. The Contractor shall obtain all permits and inspections required for the installation of this work and pay all charges incident thereto. He shall deliver to the Architect all certificates of said inspection.

1.4 WORK INCLUDED

The electrical systems installed and work performed under this division of the specifications shall include but not necessarily be limited to those listed below. All materials and appliances, obviously a part of the electrical systems and necessary to its proper operation, but not specifically mentioned or shown on the drawings, shall be furnished and installed without additional charge.

A. Power Distribution System

B. All lighting systems (indoor and outdoor, normal, emergency and exit) including all fixtures, lamps, plaster and/or tile frames, standards, switches, outlets, wiring, dimmers, contactors, time clocks, photocells, batteries, raceways and other components and fittings required for complete lighting systems
C. Wiring, including power circuit connections for HVAC, plumbing and other mechanical equipment

D. Grounding Systems

E. Temporary service lighting and power system

F. Low voltage system raceways and equipment mounting boards as indicated on the drawings

G. Fire Alarm System

H. Concrete work for equipment bases (where not assigned to General Contractor)

I. Electrical Equipment Identification

J. Supporting Devices for Electrical Components

K. Work as required by electric and telecommunication utilities, as well as the coordination of additional work (i.e. work performed by the utility) with that of other trades

1.5 DRAWINGS

A. Drawings are generally diagrammatic and show the arrangement and location of fixtures, equipment and conduit. The Contractor shall carefully investigate the structural and finish conditions affecting his work and arrange his work accordingly. Should conditions on the job make it necessary to rearrange conduit or equipment, the Contractor shall so advise the Engineer and secure approval before proceeding with such work.

B. Where exact locations are required by equipment for stubbing-up and terminating conduit concealed in floor slabs, the Contractor shall request shop drawings, equipment location drawings, foundation drawings, and any other data required by him to locate the concealed conduit before the floor slab is poured.

C. Materials, equipment or labor not indicated but which can be reasonably inferred to be necessary for a complete installation shall be provided. Drawings and specifications do not undertake to indicate every item of material, equipment, or labor required to produce a complete and properly operating installation.

D. Locate pull boxes, panelboards, control pushbuttons, terminal cabinets, safety switches and such other apparatus as may require periodic maintenance, operation, or inspection, so that they are easily accessible. If such items are shown on the plans in locations which are found to be inaccessible, the Engineer must be advised of the situation before work is advanced to the point where extra costs will be involved.

E. All additional circuit connections to panelboards must be preapproved by the Engineer.

F. The location, arrangement and extent of equipment, devices, conduit, and other appurtenances related to the installation of electrical work shown on drawings are approximate. The Contractor shall not scale drawings, but shall refer to the architectural drawings for exact dimensions of building components. Should a conflict exist between the architectural and engineering drawings regarding dimensions and scale, the Contractor shall notify the Architect of the discrepancy.
G. Verify the ceiling type, ceiling suspension systems, and clearance above hung ceilings prior to ordering lighting fixtures. Notify the Engineer of any discrepancies.

H. Review all architectural drawings for door swings, cabinets, counters and built-in equipment.

1.6 OPERATION AND MAINTENANCE MANUALS

A. The Contractor shall prepare a minimum of two (2) instruction manuals, one of which shall be submitted to the Architect for the Engineer's review, describing installation, operation and maintenance of all Electrical equipment. Manuals shall include copies of control schematics, sequences of operation, indicate the function and operations of all components, as well as the Contractor's name, address, and telephone number. Manuals shall also contain one copy of all manufacturer's drawings, pamphlets, data, parts lists, and instruction manual for each piece of equipment. Upon approval, one copy shall be delivered to the Owner; one copy shall be kept by the Contractor. The pamphlets and drawings are to be neatly bound in a 3-ring binder(s).

1.7 AS-BUILT DRAWINGS

A. The Contractor shall maintain a record of all changes in the work from that shown in the Contract Documents. After all work is completed, the Contractor shall prepare a set of “as-built” reproducible drawings of similar type and quality as the Contract Drawings that reflect all changes and that accurately show actual final construction, and deliver these drawings to the Architect.

1.8 EQUIPMENT, MATERIALS AND BID BASIS

A. Manufacturers’ names, model numbers, etc. as specified on the drawings and herein are for the purpose of describing type, capacity, function and quality of equipment and materials required.

B. Unless “approved equal” is specifically stated, bids shall be based on equipment names in specifications or on drawings as “base” products.

C. “Equal product” and “approved equal” items listed shall conform to specified base items and shall be substantially equal in size, weight, construction and capacities. The “equal” equipment and materials shall be submitted as full equivalent to the equipment and materials specified, with sufficient supportive documentation and technical literature to demonstrate quality, performance, and workmanship without doubt or question. Submittals for “equal” products shall be made at least ten (10) days prior to bid (refer to the General Conditions of these specifications). The Engineer shall consider the use of the “equal” equipment based on the supportive documentation available to him, and shall approve or disapprove any proposed alternates. The decision of the Engineer shall, in all cases, be final.

D. The Contractor shall coordinate the installation of all electrical equipment proposed for use in this project with all building trades (architectural, structural, mechanical, etc.). Coordination shall be accomplished prior to, and shall be reflected in, the submittal of shop drawings for approval. When substitution of equipment is made, the Contractor shall be responsible for the costs of any item and engineering and construction revisions necessary in his or any other contract or trade that may be required to satisfy the plans and specifications.
E. If substitutions are made in lieu of equipment specified, the manufacturer's literature shall be submitted to the Engineer for approval. In the case of lighting fixtures, full IES photometric test reports for the fixture, lamp(s), and lenses shall be submitted for approval.

1.9 SUBMITTALS

A. The Contractor shall prepare, submit, and obtain Engineer's review of manufacturers' submittals on the following equipment and systems prior to ordering, purchasing, or installation of any equipment or materials. All required submittals shall be transmitted simultaneously in hard ring binders with the associated specification section and the item submitted clearly identified. Partial submittals will be returned without review.

1. Submit a listing of all the materials indicated below, with the type of material, manufacturer and catalog or model number for each (where applicable):
   - Package #1
     - Conductors
     - Conduit
     - Multiconductor Cables
     - Wiring Devices and Plates
     - Disconnect Switches
     - Time Switches
     - Photocells
     - Lighting Contactors

2. Submit complete shop drawings of the following when supplied by the electrical contractor:
   - Package #2
     - Fuses and/or Circuit Breakers
     - Short Circuit and Coordination Study
     - Surge Protective Devices
     - Panelboards and Cabinets
   - Package #3
     - Lighting Fixtures
     - Occupancy Sensors
     - Lighting Control Panels
   - Package #4
     - Generator Set
     - Transfer Switch
   - Package #5
     - Fire Alarm System

3. Submit test reports as required in section 3.7 - Electrical Testing.

B. All shop drawing approvals required by any code or enforcement authority, insurance underwriter, etc. shall be obtained prior to being submitted to the Engineer.

C. Review of shop drawings by the Engineer does not relieve the Contractor from responsibility for complying with all requirements of the Contract Documents. Furthermore, it shall be the responsibility of the Contractor to coordinate the requirements (roof penetrations, wall penetrations, floor penetrations, curbs, electrical, etc.) of all approved equipment with the other trades and disciplines at no additional cost.
D. All shop drawings shall be identified by the equipment mark or tag identification numbers shown on the Contract Drawings. Each individual submittal item shall be marked to show which specification section pertains to the item.

1.10 COORDINATION OF TRADES

A. The Contractor shall give full cooperation to other trades, and shall furnish all information necessary to permit the work of all trades to be installed satisfactorily and with least possible interference or delay.

B. Work shall not be performed without first coordinating the installation of same with other trades. The Contractor, at his own expense, shall relocate all uncoordinated equipment installed should they interfere with the proper installation and mounting of mechanical equipment, ceilings and other architectural or structural finishes.

C. The Contractor shall coordinate the elevations of all equipment above ceilings and in exposed areas with the work of all other disciplines prior to installation.

D. In areas where more than one trade is required to use common openings in beams, joists, chases, shafts and sleeves for the passage of conduits, raceways, piping, ductwork and other materials, the Contractor must coordinate the positions of all piping and equipment to be furnished under this section so that all items including the materials and equipment of other trades may be accommodated within the space available.

E. The Contractor shall confirm that work installed under this section does not interfere with the clearances required for finished columns, pilasters, partitions, walls or other architectural or structural elements as shown on the Contract Documents.

F. Work that is installed under this Contract which interferes with the architectural design or building structure shall be removed and relocated as required at no additional cost to the Contract.

1.11 WARRANTY

A. All equipment furnished and installed under this Contract shall be provided with the manufacturer’s standard warranty unless otherwise noted.

B. The Contractor shall make good all defects in material, equipment, or workmanship disclosed within a period of one (1) year from date of building acceptance by the Owner. The phrase "make good" shall mean to furnish promptly, without charge, all work necessary to remedy the defects to the satisfaction of the Engineer.

1.12 TEMPORARY LIGHT AND POWER

A. The Contractor shall provide a temporary service of the amperage and voltage required by the Project Manager.

B. Sufficient wiring, outlets and lamps shall be installed to ensure proper lighting in accordance with OSHA, state and municipal codes. Refer to Division 1 specifications for requirements.
1.13 EQUIPMENT REQUIRING ELECTRICAL SERVICE

A. Review all specification sections and drawings including mechanical, plumbing and other equipment drawings and other divisions of the specifications for equipment requiring electrical service. Provide service to and make connections to all such equipment requiring electrical service.

B. Prior to installing material such as electrical equipment, devices, feeders, or branch circuits serving equipment of all other trades, the Contractor shall coordinate with the electrical requirements of the equipment to be installed.

1.14 MECHANICAL SYSTEMS COORDINATION

A. All control wiring for mechanical systems shall be installed under Division 15.

B. Motor controllers (starters) shall be furnished under Division 15 and installed under Division 16, unless specified otherwise.

C. Power wiring to all motors and motor controllers and between motors and controllers shall be provided in Division 16.

PART 2 - PRODUCTS

2.1 GENERAL REQUIREMENTS

A. All equipment, materials, accessories, etc. used shall be new and of current production unless specified otherwise. Equipment not specified in the Contract Documents shall be suitable for the intended use and shall be subject to approval by the Engineer.

B. All equipment, products and materials shall be free of defects and shall be constructed to operate in a safe manner without excessive noise, vibration, leakage, or wear.

C. All equipment shall bear the inspection label of Underwriters Laboratories Inc.

D. All equipment and material for similar applications or systems shall be provided from the same manufacturer unless noted otherwise.

E. The published standards and requirements of the National Electrical Manufacturers Association, the American National Standard Institute, the Institute of Electrical and Electronic Engineers, and the American Society of Testing Materials, are made a part of these specifications and shall apply wherever applicable.

2.2 IDENTIFICATION

A. Equipment or devices specified in the individual sections to be identified shall be identified by machine cut stencil unless the equipment is identified by the manufacturer. Identification of flush mounted cabinets and panelboards shall be on the inside of the device. Surface mounted equipment shall be identified on the outside cover. Equipment operating on 208Y/120 volt system shall be identified with black labels with white inner core.
B. All switchboards and panelboards supplied by a feeder shall be stencil-labeled to indicate the equipment where the power supply originates.

PART 3 - EXECUTION

3.1 GENERAL REQUIREMENTS

A. Mounting heights, unless otherwise noted, are to be center line of the equipment and/or device except the mounting height of suspended light fixtures which is to the bottom of fixture.

B. All work shall be designed and installed to comply with the requirements for the seismic design category and use group for the area in which the building is constructed.

3.2 STORAGE AND PROTECTION OF MATERIALS

A. Refer to the general requirements section of the specifications, Division 1, for storage, protection, and handling requirements.

B. Inspect materials upon arrival at project and verify conformance to Contract Documents. Prevent unloading of unsatisfactory material.

C. Store packaged materials in original undamaged condition with manufacturer’s labels and seals intact.

D. Containers which are broken, opened, watermarked, or otherwise damaged materials are unacceptable and shall be removed from premises.

E. Equipment and materials shall not be installed until such time as the environmental conditions of the job site are suitable to protect the equipment or materials. Equipment or materials damaged or which are subjected to these elements are unacceptable and shall be removed from the premises and replaced.

3.3 CONCRETE WORK

A. Construct curbs, pads, vaults and similar supports for electrical equipment where required.

B. Provide 4” thickness housekeeping pads at floor mounted equipment, covering entire area occupied by equipment. Dowel pads to structural slab.

C. Perform concrete work in accordance with applicable portions of Concrete sections. Minimum compressive strength of concrete shall be same as specified for slabs on grade.

3.4 PAINTING

A. Except as otherwise specified, painting shall be accomplished under Painting Section. Surfaces shall be left clean of debris and free from oil and other substances which would prevent paint bond.

B. Touch up finishes of factory painted apparatus where finish is marred during installation.
C. Where galvanizing is broken during fabrication or installation, recoat exposed areas with cold galvanizing compound.

D. Do not paint over nameplates on equipment, nonferrous hardware, accessories or trim.

3.5 WORKMANSHIP

A. Install systems, materials and equipment level and plumb, parallel and perpendicular to other building systems and components.

3.6 ELECTRICAL TESTING

A. Furnish all labor, materials, instruments, supplies, and services and bear all costs for the accomplishment of the tests herein specified or requested at job site. Correct all defects appearing under test, and repeat the tests until no defects are disclosed, leave the equipment clean and ready for use.

B. All grounds, crosses, shorts, etc., must be eliminated from the wiring. Test all lighting fixtures, together with switches and controls; test the operation of all motors, controllers, and other electrical equipment devices.

C. All feeders shall be Meggar tested. A copy of all test reports shall be given to the Engineer.

D. The Contractor shall perform any tests other than herein specified which may be required by the Engineer or the authority having jurisdiction.

E. Perform the following tests after installation but before energizing the equipment. The following tests and procedures apply to all equipment and material that is to be tested under this Contract.

1. Ground Resistance
   a. Visually inspect for specified ground connections.
   b. Perform ground resistance test at all connections to switchboards and panelboards.
   c. Use three point or fall of potential method.
   d. Verify single point connection (at the counterpoise) between the grounded and grounding systems.
   e. Additional ground rod is required if resistance is greater than 25 ohms.

2. Panelboards
   a. Visually inspect all components for damage.
   b. Check operation of circuit breakers/fusible switches.

3. Transfer and Other Relay Schemes
   a. Investigate intended function, and verify correct operation.

F. The Engineer shall be notified immediately of any unfavorable test results or indication of faulty equipment. No piece of equipment shall be energized until the test data is evaluated and the equipment is proven acceptable.
G. If the test and inspection data submitted should indicate deficiencies in the operation of the electrical apparatus or in the manufacturer thereof, the Contractor shall promptly implement the necessary adjustments, corrections, modifications and/or replacements necessary to meet the specified requirements.

3.7 TRAINING

A. Upon completion of the work, the Contractor shall conduct operation and training session(s) for the Owner’s key personnel. These sessions shall be of sufficient length and duration to adequately explain the design intent and proper operating and maintenance techniques for all equipment and systems. After these sessions are completed, the Contractor shall provide a copy of a signed statement by the Owner that his personnel are thoroughly familiar with and capable of operating all equipment and systems.

END OF SECTION
PART 1 - GENERAL

1.1 GENERAL REQUIREMENTS

A. This section covers the complete interior and exterior conduit system.

B. All work specified herein shall be accomplished in accordance with the applicable requirements of Section 16000 - Electrical General.

1.2 STANDARDS

A. Industry Standards

1. Underwriters Laboratories Inc. (UL) Publications
   No. 1: Standard for Flexible Metal Conduit
   No. 6: Standard for Rigid Metal Conduit
   No. 467: Standard for Grounding and Bonding Equipment
   No. 651: Standard for Schedule 40 and 80 Rigid PVC Conduit
   No. 797: Electrical Metallic Tubing - Steel
   No. 1242: Standard for Electrical Intermediate Metal Conduit – Steel

2. American National Standards Institute (ANSI)
   C-80.1: Rigid Galvanized Conduit
   C-80.3: Electrical Metallic Tubing

1.3 WORK INCLUDED

A. The work under this section shall include all labor, materials, accessories, services and equipment necessary to furnish and install conduits and raceways, complete, as indicated on the Drawings and as specified herein.

B. Other manufacturers of equal quality and performance may be submitted to the Engineer for review. When substitution of equipment is made, the Contractor shall be responsible for the costs of any item and engineering and construction revisions necessary in his or any other contract or trade that may be required to satisfy plans and specifications.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Approved Manufacturers

1. Metallic Conduit Fittings

   a. Thomas and Betts
   b. Appleton
   c. RACO
   d. Crouse Hinds
   e. Steel City
2. Support Channel
   a. Unistrut
   b. Kindorf

3. Non-metallic Conduit Fittings
   a. Carlon
   b. Georgia Pipe Company

4. Rigid, IMC or Flexible Conduit
   a. Allied
   b. Republic
   c. Triangle
   d. Wheatland
   e. Youngstown
   f. Southwire

5. Flexible Conduit (PVC Conduit)
   a. Anaconda “Sealtite”
   b. Robroy
   c. Southwire

6. Electrical Metallic Tubing
   a. Steeltubes
   b. National
   c. Wheatland
   d. Allied
   e. Triangle
   f. Youngstown

7. Plastic PVC
   a. Carlon
   b. Georgia Pipe Company

8. Pull Box Manufacturer(s)
   a. Hoffman
   b. OZ Gedney
   c. Or Approved Equal

9. Approved Marker Tape Manufacturer(s)
   a. William Frick & Associates
   b. Or Approved Equal
10. Approved Maintenance Hole/Handhole Manufacturer(s)
   a. Old Castle
   b. Pencell (Handholes Only)
   c. Quazite (Handholes Only)
   d. Or Approved Equal

11. Approved Conduit Plug/Cap Manufacturer(s)
   a. Jack Moon
   b. Or Approved Equal

2.2 CONDUIT FITTINGS
A. Electrical metallic tubing (EMT) couplings and connectors shall be steel. Malleable iron, pressure cast or die cast fittings are not permitted.

B. Fittings and couplings shall be set-screw type and/or compression type per 3.1 12. Steel set screw type for 2.5" conduit and larger shall have 2 screws for connectors and 4 screws for couplings. All connectors shall be insulated throat type.

C. Rigid steel and IMC couplings and connectors shall be standard threaded couplings, locknuts, bushings and elbows. All materials shall be steel. Erickson-type couplings may be used to complete a conduit run.

2.3 NON-METALLIC CONDUIT AND FITTINGS
A. Non-metallic conduit shall be heavy wall, Schedule 40 PVC.

B. Couplings and connectors for non-metallic conduit shall be of the same material and be the product of the same manufacturer of the conduit furnished.

C. PVC conduit for concrete encasements shall be Type DB, UL Labeled for 90 degrees C cables. Fittings shall be Type DB, solvent type, and from the same manufacturer as the conduit.

D. Concrete shall have a minimum strength of 2,500 psi at 28 days.

2.4 CONDUIT SUPPORT
A. Individual conduit hangers shall be galvanized spring steel specifically designed for the purpose and sized appropriately for the conduit type and diameter. Support individual conduits 1-1/2" and smaller with 1/4" threaded steel rods and use 3/8" rods for 2" and larger.

B. Conduit support channels shall be 14-gauge galvanized (or equivalent treatment) channel sized for the amount of conduit to be supported. Channel suspension shall be 3/8" threaded steel rods. Conduit straps shall be spring steel type compatible with channel.

C. Conduit straps shall be single-hole cast metal type or two-hole galvanized metal type. Conduit clamps shall be spring steel type for use with exposed structural steel.
2.5 RIGID METALLIC CONDUIT, INTERMEDIATE METALLIC CONDUIT, AND ELECTRICAL METALLIC TUBING

A. Rigid metallic conduit and intermediate metallic conduit shall be steel and standard thread.

B. Electrical metallic tubing (EMT) shall be steel.

2.6 RIGID METALLIC, INTERMEDIATE METALLIC, AND FLEXIBLE CONDUIT AND FITTINGS

A. Rigid metallic conduit and intermediate metallic conduit shall be steel and standard thread.

B. Flexible conduit shall be steel or aluminum type classified for system grounding.

C. Connectors for flexible conduit shall be insulated throat type rated as suitable for system ground continuity.

D. Flexible conduit used for other than connections to lighting fixtures shall not be less than 1/2" trade size. 3/8" flexible conduit may be used for connection to lighting fixtures when sized according to the National Electrical Code.

E. Flexible conduit used in damp or wet locations shall be liquid tight.

2.7 PULL BOXES

A. Pull boxes shall be constructed of galvanized steel with flat, removable covers fastened with plated steel screws.

B. Pull boxes shall be equipped with keyhole screw slots in the cover to permit removal of the cover without extracting the screws.

C. Pull boxes shall have provisions for grounding.

2.8 MAINTENANCE HOLES/HANDHOLES

A. Maintenance Holes

1. Maintenance holes shall be pre-cast or cast in place concrete with a strength of 3,500 psi at 28 days, and steel reinforced.

2. Maintenance holes shall include a cast iron frame with cover, a hot dipped galvanized steel ladder, and hot dipped galvanized pulling eyes embedded in the concrete opposite each duct entrance and in the floor beneath the cover.

3. Maintenance holes shall be equipped with grounding busbar.

4. Maintenance holes shall be equipped with racking for cable storage.

5. Ground splices and connections at maintenance holes shall be exothermic welds, copper or bronze compression ground fittings, or bolted compression ring lugs.

6. The cover for electrical maintenance holes shall have the lettering, “POWER” or “ELECTRIC.”

7. The cover for low voltage maintenance holes shall have the lettering, “COMMUNICATIONS.”
B. Handholes

1. Handholes shall be non-conductive and shall not require grounding for safety. Handholes shall be unaffected by freeze/thaw and resistant to sunlight and chemicals. Handholes shall be pre-cast polymer concrete, heavy duty rated and bottomless.

2. Handholes shall be equipped with racking for cable storage.

3. Electrical handholes shall have the word “POWER” or “ELECTRIC” molded in the cover by the manufacturer. The cover shall be attached with penta-head stainless steel bolts.

4. Low voltage handholes shall have the word “COMMUNICATIONS” molded in the cover by the manufacturer. The cover shall be attached with penta-head stainless steel bolts.

5. Handholes shall be able to withstand 10,000 lbs minimum.

6. See Drawings for handhole dimensions and locations.

2.9 CONDUIT PLUGS/CAPS

A. Conduit Plugs/Caps

1. Conduit plugs shall provide a watertight seal at expose ends of conduits.

2. Conduit plugs shall be conduit size specific.

PART 3 - EXECUTION

3.1 INSTALLATION

A. General

1. Minimum size for electrical conduits shall be 1/2" trade size.

2. Minimum size for low voltage conduits shall be 3/4" trade size.

3. Conceal all conduits, except in unfinished spaces such as equipment rooms or as indicated by symbol on the drawings.

4. Leave all empty conduits with a 200 pound test nylon cord pull line.

5. Flattened, dented, or deformed conduits are not permitted and shall be removed and replaced.

6. Fasten conduit support device to structure with wood screws on wood, toggle bolts on hollow masonry, anchors as specified on solid masonry or concrete, and machine bolts, clamps, or spring steel clips, on steel.

7. Protect conduits against dirt, plaster, and foreign debris with conduit caps or plugs, which shall remain in place until all masonry is complete. Protect conduit stub-ups during construction from damage, any damage conduits shall not be used and are to be replaced.

8. All feeder conduits shall be cleared of any dirt, foreign debris, etc.

9. Install conduit with wiring, including home runs as indicated on the drawings. Any change resulting in a savings in labor or materials is to be made only in accordance with a Contract change. Deviations shall be made only where necessary to avoid interferences and when approved by Engineer by written authorization.

10. Conduits which penetrate roof membranes shall be installed in accordance with manufacturer’s recommendations and architectural specifications.
11. Seal all conduits entering building from below grade, all conduits entering refrigerated spaces i.e. freezers and coolers, and all conduits entering exterior mounted electrical equipment with insulating electrical putty to prevent entrance of moisture.

12. Separate raceway systems are to be installed for power systems and for control, signal and communications systems. Do not install control, signal or communications cables in the same raceways as branch circuit or feeders cables, unless indicated otherwise on the drawings.

13. Conduit fittings shall be set screw type for dry, indoor environments. Conduit fittings shall be gland and ring compression type for all conduit exposed to outdoor environments or wet locations.

14. Conduit shall be run parallel or at right angles to walls, ceilings, and structural members.

15. Support conduits at intervals not exceeding ten feet and within three feet of each outlet, junction box, fitting, panelboard, enclosure or cabinet. Support conduits from structural steel members with spring steel type or beam conduit clamps and to non-metallic structural members with one-hole conduit straps. For exposed conduits and where conduits must be suspended below structure, single conduit runs shall be supported from structure by hanger rod and conduit clamp assembly, and multiple conduits shall be supported by trapeze type support suspended from structure. Do not attach conduits to ceiling suspension system channels or suspension wires.

16. Attach feeder conduits larger than one inch trade diameter to or from structure on intervals not exceeding twelve feet with conduit beam clamps, one-hole conduit straps or trapeze type support.

17. Where conduits must pass through structural members obtain approval of Architect.

18. Install all conduits or sleeves penetrating or routed within rated fire walls or fire floors to maintain fire rating of wall or floor. Conduit shall not be installed in rated floors or walls if it compromises or violates the fire rating of floor or wall. Refer to architectural documents.

19. Provide expansion and deflection coupling where conduit passes over a building expansion joint.

20. Keep raceways at least 6 inches away from parallel runs of flues and steam or hot-water pipes. Install horizontal raceway runs above water and steam piping.

21. Telephone and signal system raceways: 2” trade size and smaller: In addition to above requirements, install raceways in maximum lengths of 150 feet and with a maximum of two 90-degree bends or equivalent. Separate lengths with pull or junction boxes where necessary to comply with these requirements.

B. Uses Permitted

1. Conduits installed within concrete floor slabs shall be galvanized rigid steel (GRS), intermediate metal conduit (IMC), Schedule 40, heavy wall PVC, or electrical non-metallic tubing (ENT).

2. Conduit run exterior exposed: Galvanized rigid steel (GRS) or intermediate metal conduit (IMC).

3. Conduits in direct contact with earth shall be Schedule 40, heavy wall PVC. Elbows for underground conduits greater than 200’ in length shall be galvanized rigid steel (GRS), or electrical metallic tubing (EMT) if elbows are concrete encased. Service entrance conduits installed exposed, or concealed in walls or above ceilings, shall be galvanized rigid steel (GRS) or intermediate metal conduit (IMC). Unless indicated otherwise, service entrance conduits shall be installed
“outside” of the building as defined by the NEC. Provide concrete encasement where required or as indicated on drawings.

4. All other conduit, unless specified herein, not permitted in accordance with the NEC, or otherwise indicated on the drawings, shall be electrical metallic tubing (EMT). PVC conduit is not allowed in exposed or concealed areas, but only within concrete or below grade. Feeder or branch circuit conduits that emerge from a floor slab in an exposed location shall be galvanized rigid steel (GRS), electrical metallic tubing (EMT) or intermediate metal conduit (IMC). Where conduits emerge from a floor slab in a concealed location (a wall cavity or above ceiling), PVC elbows are permitted, provided that a conduit adaptor for steel conduit is installed at the nearest point at the slab.

5. Use flexible conduit for connections to motors, electrical duct heaters, unit heaters, kitchen equipment, laundry equipment, flush mounted lighting fixtures, and any vibrating equipment.
   a. Flexible conduit used for connection of motors, electric duct heaters, and unit heaters
   b. Flexible conduit from outlet box to flush mounted lighting fixture shall not exceed 6 feet in length.
   c. Maintain ground continuity through flexible conduit with green equipment grounding conductor; do not use flexible conduit for ground continuity.
   d. Flexible conduit installed within plenum spaces shall be limited to lengths not exceeding 4 feet.
   e. Liquid tight flexible conduit shall be used to connect equipment in exterior, damp or wet locations.

6. All conduit from the fire pump controller to the fire pump shall be either galvanized rigid steel (GRS) or liquid tight flexible conduit.

C. Below Grade Raceway Installations

1. Install top of conduits 2 inches minimum below bottom of building slabs.

D. Raceway Installations within Concrete

1. Conduit shall be run following the most direct route between points.
2. Conduit shall not be installed in concrete where the outside diameter is larger than 1/3 of the slab thickness.
3. Conduits shall not be installed within shear walls unless specifically indicated on the drawings. Conduit shall not be run directly below and parallel with load bearing walls.
4. Protect all conduits entering and leaving concrete floor slabs from physical damage during construction.
5. Provide expansion fittings in all conduits that pass through building expansion joints.

3.2 PULL BOXES

A. Pull boxes shall be secured, independent of the conduit entries into the box. Pull boxes shall be secured to the building structure. In ceiling applications, pull boxes shall not be supported with ceiling wires.
B. Conduits entering pull boxes shall connect to pull boxes using die-cast zinc connectors.

C. Pull boxes shall be free from burrs, dirt and debris.

3.3 MAINTENANCE HOLES/HANDBOLES

A. Maintenance holes/handholes shall be installed on a base of pea gravel at least 12 inches deep.

B. Tops of maintenance holes/handholes shall be level with the existing grade.

C. Ducts should enter as perpendicular to the wall surface as possible.

D. Maintenance holes shall be grounded with four 3/4 inch diameter by 8 foot long ground rods, one driven inside of the maintenance hole at each corner. Connect the ground rods and any duct bank ground conductors together with a No. 4/0 AWG bare, stranded copper ground wire loop. A No. 2 AWG bare stranded copper pigtail from the ground wire loop shall be used to ground the maintenance hole cover frame, ladder support bracket, any metallic concrete inserts and metallic cable racks, and the shields of any cables that are spliced in the maintenance hole.

3.4 CONDUIT PLUGS/CAPS

A. Protect conduits against dirt, plaster, and foreign debris with conduit plugs. Plugs shall remain in place until ready for use.

B. Simplex, triplex or quadplex duct plugs shall be installed in conduits to house and seal cables.

3.5 ADDITIONAL REQUIREMENTS FOR INTERIOR LOW VOLTAGE CONDUITS

A. Conduit runs shall not have more than two (2) 90-degree bends between pull points.

B. Communications conduit system shall contain no condulets (also known as an LB).

C. Rigid metal conduit (RMC) or intermediate metal conduit (IMC) shall be used for entrance conduits that exceed 50 feet into the building.

D. Horizontal Conduits

1. Support horizontal conduits at intervals not exceeding ten feet and within three feet of each outlet, junction box, backboard, enclosure or cabinet. Support conduits from structural steel members with spring steel type or beam conduit clamps and to non-metallic structural members with one-hole conduit straps. For exposed conduits and where conduits must be suspended below structure, single conduit runs shall be supported from structure by hanger rod and conduit clamp assembly, and multiple conduits shall be supported by trapeze type support suspended from structure. Do not attach conduits to ceiling suspension system channels or suspension wires.

2. For runs that total more than 100 feet in length, insert pull boxes so that no segment between boxes exceeds the 100 feet limit.

3. Each horizontal home-run conduit can serve from one (1) to three (3) outlet boxes. For one (1) outlet box, a 3/4" conduit shall be used, minimum. For two (2) outlet
boxes, a 1" conduit shall be used, minimum. For three (3) outlet boxes, a 1-1/4" conduit shall be used, minimum.

END OF SECTION
PART 1 - GENERAL

1.1 GENERAL REQUIREMENTS

A. Applicable requirements of Division 16 shall be considered a part of this section and shall have the same force as if printed herein full.

B. This document describes the products and execution requirements relating to Firestopping for Electrical Systems.

C. Product specifications, general design considerations, and installation guidelines are provided in this document. Typical firestopping installation details will be provided on Drawings as an attachment to this document. If the bid documents are in conflict, the Drawings shall take precedence. The successful Contractor shall meet or exceed all requirements described in this document.

1.2 WORK INCLUDED

A. The work included under this Specification consists of furnishing all labor, equipment, materials, supplies and performing all operations necessary to complete the installation. The Contractor will provide and install all of the required material whether specifically addressed in the Specification or not.

B. The work shall include, but not be limited to the following:

1. Furnish and install all Firestopping Materials.

PART 2 - PRODUCTS

2.1 APPROVED PRODUCTS

A. Approved Firestopping manufacturer(s)

1. FlameStopper Thru-Wall Fitting - Wiremold Company (Firestop Devices)
2. Tremco Inc. (Firestop Cast in Place Sleeves, Caulks, QuickComm Sleeves, QuickComm Units, Pillows, Putty Pads, Outlet Box Inserts, Silicone, Composite Sheets, Collars, Devices)
3. STI Firestop Products (Firestop Devices, Putties, Caulks, Sealants, etc.)
4. Hilti (Putties, Caulks, Sealants, etc.)

2.2 TYPES OF PRODUCTS

A. Firestop Products

1. Intumescent Firestop Sealants and Caulks
2. Acrylic Firestop Sealant and Caulks
3. Silicone Firestop Sealants and Caulks
4. Cast in Place Devices
5. Firestop Putty, Putty Pads
6. Outlet Box Inserts
7. QuickComm Sleeves
8. TREMstop Straps
9. Firestop Collars
10. Wrap Strips
11. Firestop Mortar
12. Firestop Pillows
13. Accessories: Forming/Damming Materials: Mineral Wool, Backer Rod or other type as per manufacturer recommendation.

B. Firestop Devices

1. Thru-Wall Fitting (FlameStopper by Wiremold)
   a. The firestop device box shall be constructed of 16-gauge G90 steel.
   b. The firestop device intumescent block shall be constructed of a graphite base material with expansion starting at 375 degrees F and an unrestrained expansion between 6 to 12 times. The intumescent block shall be held securely by the box in order to prevent tampering and damage during installation.
   c. The firestop device shall have doors which can be adjusted to prevent materials from penetrating the device if the device is empty or completely full. The doors shall be constructed of 16-gauge G90 steel with No. 10-32 screws use to adjust opening size.
   d. The firestop device shall be available for 2" and 4" trade size EMT conduit.
   e. The firestop device shall be available in safety yellow powder coat, custom colors and an unpainted galvanized finish.

2. Fire Rated Cable Pathway (STI EZ-PATH)
   a. Fire rated cable pathway device modules shall be comprised of steel raceway with intumescent foam pads allowing 0 - 100% cable fill.

3. Tremco (QuickComm Unit) 24" x 12" or 34" x 18"
   a. Fire rated steel frame with an intumescent channel. UL Tested for large openings with 100% visual cable fill. UL Tested for Concrete Floors, Block Walls, Dry Walls and Hollow Core Floors.

4. Tremco (QuickComm Sleeve)
   a. Fire rated steel sleeve with an intumescent inner sleeve. UL Tested for Concrete Floors, Block Walls, Dry Walls, Hollow Core and Fluted Decks.

2.3 UL CLASSIFICATION

A. Thru-Wall Fitting: The firestop device for use in through-penetration firestop systems shall have been examined and tested by Underwriters Laboratories Inc. to UL1479 (ASTM E 814 & ASTM E 84).

B. Threaded, Smooth and Split-Sleeve Firestop Devices: Firestopping sealants and devices shall be used together as a firestop system. All firestop systems shall bear a UL Classification system number.
C. QuickComm Sleeve: Firestop Sleeve for use in through penetration firestop systems. Shall be tested by Underwriters Laboratories Inc. or a recognized Testing Laboratory for through penetration fire stopping applications.

D. QuickComm Unit: Intumescent Firestopping Unit for use in large openings for firestopping for cables, Fiber optic, Power Control, Telecommunications

1. Threaded Firestop System
   a. Block Wall - W-J-3049
   b. Dry Wall - W-L-3138

2. Threaded Firestop System (Vertical)
   a. Slab - F-A-3010

3. Smooth Firestop System
   a. Block Wall - W-J-3048
   b. Dry Wall - W-L-3137

4. Split-Sleeve Firestop System
   a. Block Wall - W-J-3047
   b. Dry Wall - W-L-3136

5. Tremco QuickComm Sleeve
   a. Block Wall- C-AJ-0123, C-AJ-2580, C-AJ-3270
   b. Dry Wall- WL-0025, WL-2418, WL-3318
   c. Concrete Floor- C-AJ-0123, C-AJ-2580, C-AJ-3270
   d. Fluted Deck- C-AJ-0123
   e. Hollow Core- C-AJ-0123, C-AJ-2580, C-AJ-3318

6. Tremco QuickComm Unit
   a. Dry Wall- WL-3319, WL-4070
   b. Concrete Floor- F-A-3035, F-A-4006

2.4 FIRESTOPPING SYSTEMS

A. Thru-Wall Fitting Firestop System

1. The device shall be classified for use in one-, two-, three-, and four-hour rated gypsum, concrete and block walls and provide an L rating of less than 5 cfm. The device shall also be tested by Underwriters Laboratories Inc. to UL2043 and determined to be suitable for use in air handling spaces.

B. Threaded, Smooth and Split-Sleeve Firestop Systems

1. Shall conform to both Flame (F) and Temperature (T) ratings as required by local building codes and as tested by nationally accepted test agencies per ASTM E814
and ASTM E 84 (UL 1479) fire tests in a configuration that is representative of field conditions.

2. The F rating must be a minimum of one (1) hour but not less than the fire resistance rating of the assembly being penetrated. T rating when required by code authority shall be based on measurement of the temperature rise on penetrating item(s). The fire test shall be conducted with a minimum positive pressure differential of 0.01 inches of water column.

C. Firestopping materials and systems must be capable of closing or filling through-openings created by the burning or melting of combustible pipes, cable jacketing, or pipe insulation materials.

D. Firestopping material shall be asbestos and lead free and shall not incorporate nor require the use of hazardous solvents.

E. Firestopping sealants must be flexible, allowing for normal pipe movement.

F. Firestopping materials shall not shrink upon drying as evidenced by cracking or pulling back from contact surfaces.

G. Firestopping materials shall be moisture resistant, and may not dissolve in water after curing.

H. Firestopping material shall be installed inside the cavity of the wall as shown by the annular space requirements in the UL Tested System.

PART 3 - EXECUTION

3.1 CONDITIONS REQUIRING FIRESTOPPING

A. General

1. Provide firestopping for conditions specified whether or not firestopping is indicated, and if indicated, whether such material is designed as insulation, safing, or otherwise.

B. Through-Penetrations

1. Firestopping shall be installed in all open penetrations and in the annular space in all penetrations in any bearing or non-bearing fire-rated barrier.

C. Membrane-Penetrations

1. Where required by code, all membrane-penetrations in rated walls shall be protected with firestopping products that meet ASTM E 814 and ASTM E 84 Test requirements.

D. Smoke-Stopping

1. As required by the other sections, smoke-stops shall be provided for through-penetrations, membrane-penetrations, and construction gaps with a material approved for the ASTM E 136 Standards.
3.2 EXAMINATION

A. Examine the areas and conditions where firestops are to be installed and notify the Architect of conditions detrimental to the proper and timely completion of the work. Do not proceed with work until unsatisfactory conditions have been corrected.

B. Verify that environmental conditions are safe and suitable for installation of firestop products.

C. Verify that all pipes, conduit, cable, and other items that penetrate fire-rated construction have been permanently installed prior to installation of firestops.

3.3 INSTALLATION

A. General

1. Through Penetration firestop submittals showing each UL Rated Assembly shall be located in the general Contractor’s trailer for inspection purposes.

2. Installation of firestops shall be performed by an applicator/installer qualified and trained by the manufacturer. Written documentation stating training done on the specific project shall be supplied to the General Contractor for inspection purposes. Installation shall be performed in strict accordance with manufacturer’s detailed installation procedures.

3. Apply firestops in accordance with UL Tested Systems, fire resistance requirements, acceptable sample installations, and manufacturer’s recommendations.

4. Unless specified and approved, all insulation used in conjunction with through-penetrants shall remain intact and undamaged and may not be removed.

5. Seal holes and penetrations to ensure an effective smoke seal. In areas of high traffic, protect firestopping materials from damage. If the opening is large, install firestopping materials capable of supporting the weight of a human.
   a. Insulation types specified in other sections shall not be installed in lieu of firestopping material specified herein.
   b. All combustible penetrants (e.g. non-metallic pipes or insulated metallic pipes) shall be firestopped using products and systems tested in a configuration representative of the field condition.

B. Dam Construction

1. When required to properly contain firestopping materials within openings, damming or packing materials may be utilized. Combustible damming material must be removed after appropriate curing. Noncombustible damming materials may be left as a permanent component of the firestop system.

3.4 FIELD QUALITY CONTROL

A. Preconstruction meeting shall take place to address firestopping systems to be installed.

B. Prepare and install firestopping systems in accordance with UL Tested System and manufacturer’s printed instructions and recommendations.

C. Follow safety procedures recommended in the Material Safety Data Sheets.
D. Finish surfaces of firestopping that are to remain exposed in the completed work to a uniform and level condition.

E. All areas of work must be accessible until inspection by the applicable Code Authorities.

F. Correct unacceptable firestops and provide additional inspection to verify compliance with this Specification.

3.5 CLEANING

A. Remove spilled and excess materials adjacent to firestopping without damaging adjacent surfaces.

B. Leave finished work in a neat and clean condition with no evidence of spillovers or damage to adjacent surfaces.

END OF SECTION
PART 1 - GENERAL

1.1 GENERAL REQUIREMENTS

A. All work specified herein shall be accomplished in accordance with the applicable requirements of Section 16000 - Electrical General.

1.2 WORK INCLUDED

A. The work under this section shall include all labor, materials, accessories, services and equipment necessary to furnish and install conductors, complete, as indicated on the Drawings and as specified herein. Provide a complete system of wiring with all feeders and branch circuits as shown on the Drawings. The wiring system shall be complete to each and every outlet and apparatus shown on the Drawings which requires electrical connections.

B. This section includes wires, cables, and connectors for power, lighting, signal, control and related systems rated 600 volts or less.

1.3 COLOR CODING

A. Color coding shall be as follows:

<table>
<thead>
<tr>
<th>120/208 Volt System</th>
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</thead>
<tbody>
<tr>
<td>Phase A – Black</td>
</tr>
<tr>
<td>Phase B – Red</td>
</tr>
<tr>
<td>Phase C – Blue</td>
</tr>
<tr>
<td>Neutral – White</td>
</tr>
<tr>
<td>Ground – Green</td>
</tr>
<tr>
<td>Isolated Ground - Green with yellow strip (where applicable)</td>
</tr>
</tbody>
</table>

(Verify color-coding with local code Authority and use local code requirements if and only if the above color code is not acceptable to local authority.)

B. All wire shall be color coded throughout its entire length. Colored phase tape is not allowed.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Acceptable Manufacturers: Wire shall be Southwire/SIMpullTM, Pirelli, Rome, General Cable, Senator, United Copper Industries, Alcan, AFC, or approved equal.
2.2 CONDUCTORS

A. Conductor Material: Unless noted otherwise, conductors shall be copper, 98.5% conductivity except where specifically noted otherwise on Drawings.

B. All wire and cable for feeders and branch circuits shall have copper conductors and shall be 600 volts, 90 degrees C, NEC type conductors with THHN/THWN-2 insulation.

C. Wire No. 8 AWG and larger shall have stranded conductors. Wire No. 10 AWG and smaller shall be solid conductor type.

D. No conductor shall be smaller than No. 12 AWG unless otherwise specified or noted.

E. Branch circuit wiring which supplies more than one fluorescent fixture through the wiring of other fixtures shall be high temperature wire approved for such use.

F. Pulling lubricant is neither required nor allowed for Southwire/SIMpull™ conductors.

2.3 ALUMINUM CONDUCTORS

A. Where substituted for copper conductors, aluminum conductors shall match or exceed copper ampacity.

B. Aluminum conductors shall be compact, Alcan, or Southwire. Conductors shall be AA-8000 series.

C. Aluminum conductors shall not be used for branch circuits, and shall not be installed to any vibrating equipment (e.g. mechanical equipment, transformers, elevators, fire pumps). Minimum rating of feeder size shall be 100 amps.

D. Mechanical screw-type connectors shall comply with the following:
   1. Connectors shall be dual rated (AL7CU or AL9CU) and listed by UL for use with aluminum and copper conductors and sized to accept aluminum conductors of the ampacity specified.
   2. Using a suitable stripping tool, to avoid damage to the conductors, remove insulation from the required length of the conductor.
   3. Wire brush the conductor and apply a listed joint compound.
   4. Tighten the connection per the connector manufacturer’s recommendation.
   5. Wipe off any excess joint compound.

E. For connection to aluminum bus, the following hardware shall be used:
   1. Bolts: Anodized alloy 2024-T4 and conforming to ANSI B18.2.1 and to ASTM B211 or B221 chemical and mechanical property limits.
   2. Nuts: Aluminum alloy 6061-T6 or 6262-T9 and conforming to ANSI B18.2.2.
   3. Washers: Flat aluminum alloy 2024-T4, Type A plain, standard wide series conforming to ANSI B27.2.
   4. Lubricate and tighten the hardware as per the manufacturer’s recommendations.
F. For connection to copper bus, the following hardware shall be used:

1. Bolts: Plated or galvanized medium carbon steel; heat treated, quenched and tempered equal to ASTM A-325 or SAE grade 5.
2. Nuts: Heavy semi-finished hexagon, conforming to ANSI B18.2.2, threads to be unified coarse series (UNC), class 2B.
3. Washers: Should be steel, Type A plain standard wide series conforming to ANSI B27.2.
4. Belleville conical spring washers: shall be of hardened steel, cadmium plated or silicone bronze.
5. Lubricate and tighten the hardware as per the manufacturer’s recommendations.

G. Aluminum conductors shall not be used where expressly forbidden by the local electrical inspections department or plan review board of jurisdiction. The electrical contractor shall verify this requirement prior to bid.

H. Aluminum conductors shall not be connected to equipment which is not UL Listed for aluminum.

2.4 METAL CLAD “MC” CABLE

A. Where allowed by the authority having jurisdiction, the use of metal clad cable is permitted as described below and shall meet all the requirements of the following codes and standards:

1. Underwriters Laboratories Inc. 83, 1479, 1569, and 1581
2. National Fire Protection Association NFPA 70, Article 330
3. All local codes and municipal ordinances.

B. The conductors of the metal clad cable shall comply with Articles 1.3 and 2.2 of this same section.

C. MC cable shall be limited to branch circuits concealed in walls or above ceilings. Unless noted otherwise, metal clad cable may not be run directly into surface-mounted panels, cabinets, switches or other devices. All circuit homeruns shall be installed in conduit and shall be routed from the panelboard to the first branch circuit device.

D. MC cable shall not be allowed for wiring to mechanical equipment.

E. Unless noted otherwise, the metal clad cable shall be MC with either a galvanized steel jacket or aluminum interlocked armor, a Mylar assembly covering tape, rated at 90 degrees centigrade, with either a green insulated grounding conductor or MCAP Type MC cable with interlocked armor that is listed and identified for grounding, and rated for a maximum of 600 volts.

F. Refer to National Electrical Code Article 330 for uses not permitted.

G. Cables installed in other than vertical runs through bored or punched holes in wood or metal framing members, or through notches in wooden framing members and protected by a steel plate at least 1/16 inches thick, shall be considered supported and secured where such support does not exceed six (6) foot intervals.
H. Cables containing four or fewer conductors sized not larger than No. 10 AWG shall be secured within 12 inches of every box, cabinet, fitting or other cable termination.

I. Metal clad cable shall not be installed outside the building without written authorization from the Engineer.

2.5 ACCESSORIES

A. Wire Joints: T & B “Sta-Kon,” Scotchlok Type “R,” Ideal No. 452 or 453, or Buchanan “B-Cap.”

B. Cable Connectors: Solderless Type O.Z. “circular clamp type” or T & B “lock-tite” appropriate for the particular application involved.

PART 3 - EXECUTION

3.1 PREPARATION

A. Lubricant: No grease, oil or lubricant other than powdered soapstone or approved pulling compound shall be used to facilitate the pulling of wires. Lubricant shall not be used for conductors with SIMpull™ insulation.

3.2 INSTALLATION

A. Complete electrical systems shall be provided as shown on the Drawings and/or as specified herein.

B. Wires shall be pulled without excessive strain to prevent damage to conductor or insulation. Provide pull boxes as required to facilitate pulling of wire.

C. Prior to energizing, all service and feeder cables shall be tested with megohm meter to determine insulation resistance levels. Test report shall be submitted to the Engineer.

D. Each raceway indicated by symbol on Drawings shall contain three (3) No. 12 AWG wires unless otherwise noted, scheduled or indicated. Hatch marks on raceway symbols indicate the number of conductors in a raceway when the number exceeds three (3).

E. At each fixture or device outlet, a loop or end of wire not less than 6” long shall be left for connection to fixture or device.

F. Splices, taps and connections shall be made up as follows:

1. Wire sizes No. 10 AWG and smaller with wire nuts.
2. Wire and cable of sizes No. 8 AWG and larger, with insulated mechanical or crimped connectors.

G. Perform conductor tests as described in Section 16000 - Electrical General.

END OF SECTION
PART 1 - GENERAL

1.1 GENERAL REQUIREMENTS

A. All work specified herein shall be accomplished in accordance with the applicable requirements of Section 16000 - Electrical General.

1.2 WORK INCLUDED

A. The work under this section shall include all labor, materials, accessories, services and equipment necessary to furnish and install outlet and junction boxes, complete, as indicated on the Drawings and as specified herein.

B. Equipment schedules and specifications are based on the one manufacturer listed in the schedule. Other manufacturers of equal quality and performance may be submitted to the Engineer for review. When substitution of equipment is made the Contractor shall be responsible for the costs of any item and engineered and construction revisions necessary in his or any other contract or trade that may be required to satisfy plans and specifications.

1.3 QUALITY ASSURANCE

A. Sheet Metal Outlet and Device Boxes: NEMA OS 1.

B. Cast-Metal Outlet and Device Boxes: NEMA FB 1, Type FD, with gasketed cover.

C. Nonmetallic Outlet and Device Boxes: NEMA OS 2.

D. Small Sheet Metal Pull and Junction Boxes: NEMA OS 1.

E. Cast-Metal Pull and Junction Boxes: NEMA FB 1, cast aluminum with gasketed cover.

F. Hinged-Cover Enclosures: NEMA 250, Type 1, with continuous hinge cover and flush latch.

   1. Metal Enclosures: Steel, finished inside and out with manufacturer’s standard enamel.

G. Cabinets: NEMA 250, Type 1, galvanized steel box with removable interior panel and removable front, finished inside and out with manufacturer’s standard enamel. Hinged door in front cover with flush latch and concealed hinge. Key latch to match panelboards. Include metal barriers to separate wiring of different systems and voltage and include accessory feet where required for freestanding equipment.

1.4 JOB CONDITIONS

A. Protection: Anchor boxes securely to formwork. Provide necessary protection to prevent entry of concrete.

B. Sequencing, Scheduling: Locations of outlets shown on the Drawings are relative and approximate. Exact locations shall be determined on the job and the outlets accurately
set according to the architectural drawings, dimensions, casework kneespace, building conditions, furniture positions and Architect’s direction. The right is reserved to change the exact location (10'-0" or less) of any switch, ceiling outlet or other outlet in any room before it is permanently installed without increase in Contract cost.

C. All outlet boxes and junction boxes shall be accessible. Any boxes in non-accessible areas (furred ceilings) shall be set flush with barrier surface at a location approved by the Architect.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Acceptable Manufacturers: National Electric Products Company, Thomas & Betts/Steel City, Appleton or Raco.

2.2 OUTLET BOXES

A. Standard Outlet Boxes: Boxes and covers shall be galvanized steel not less than 1/16" thick and in every instance, of such form and dimensions as to be adapted to its specific use and location, kind of fixtures to be used and number, size and arrangement of conduits connecting thereto and particularly sized to accommodate the number and size of wires to be contained therein.

B. Ceiling outlet boxes shall be 1-1/2" or 3-3/8" deep, 4" octagonal (or 4" square when required due to number of wires). Plaster rings or device covers need not be provided on ceiling boxes. Provide extension rings on ceiling boxes to accommodate number of conductors in box.

C. Wall outlet boxes for toggle switches and convenience outlets shall be 1-1/2" or 2-1/8" deep, 4" or 4-11/16" square. Provide with single-device covers (or two-device covers where needed). Covers shall be raised type to compensate for thickness of plaster or gypsum board wall finish.

D. Outlet boxes for telecommunication purposes (telephone, data, etc.) shall be 4" x 4" square, 2-1/8" deep. Provide with single device covers (or two-device covers where needed). Covers shall be raised type to compensate for thickness of plaster or gypsum board wall finish.

E. Junction boxes shall be as specified for ceiling and wall outlet boxes. Provide flat covers on ceiling outlets to match ceiling finish. Provide blank device type coverplates on wall outlets, of same materials as specified for device coverplates in same room or area.

F. Outlet boxes where exposed rigid conduit is used shall be cast ferrous alloy, galvanized or cast aluminum.

G. Covers: Where outlet boxes are to be capped, blank coverplates shall be used.

H. Barriers: Provide barriers between devices operating at different voltages or on separate systems such as normal, critical, or life safety.
2.3 FLOOR BOXES

A. Product Description

1. Floor boxes for receptacles and telephone/data outlets shall be rectangular, non-metallic PVC. Boxes shall be suitable for use in slab-on-grade or above grade. Boxes shall include a non-metallic concrete cover to prohibit concrete or debris from entering the box during installation.

2. Provide number of compartments as indicated on drawings.

3. Coverplates and flanges shall be brass.

4. Floor box device covers shall meet UL 514C requirements for scrubwater test standards.

B. Manufacturer

1. Hubbell PFBRG Series
2. Walker/Wiremold 880MP Series
3. Thomas & Betts 640P Series

C. For poke-thru devices, refer to 2.4 D of Section 16140 - Wiring Devices.

2.4 PULL AND JUNCTION BOXES

A. Pull and Junction boxes are not completely indicated. They shall be sized and installed where required in accordance with the NEC.

B. Pull and Junction boxes shall be the suitable NEMA type number to match the environmental conditions.

C. Locations of concealed pull and junction boxes shall be indicated on the record as built drawings for Owner's record.

2.5 CABINETS, FITTINGS, BOXES: GENERAL

A. Cabinets shall be in accordance with UL 50, “Electrical Cabinets and Boxes” and NEMA 250, Type 1. Electrical cabinets, boxes and fittings shall be as required for types, sizes, and NEMA enclosure classes. Where not indicated, provide units of types, sizes, and classes appropriate for the use and location. Provide all items complete with covers and accessories required for the intended use. Provide gaskets for units in damp or wet locations.

B. Construction shall be sheet steel, NEMA 1 class except as otherwise indicated. Cabinets shall consist of a box and a front consisting of a 1-piece frame and a hinged door. Arrange door to close against a rabbet placed all around the inside edge of the frame, with a uniformly close fit between door and frame. Provide concealed fasteners, not over 24" apart, to hold fronts to cabinet boxes and provide for adjustment. Provide flush or concealed door hinges not over 24" apart and not over 6" from top and bottom of door. For flush cabinets, make the front approximately 3/4" larger than the box all around. For surface mounted cabinets make from same height and width as box. Furnish metal barriers to separate wiring of different systems and voltage, and furnish accessory feet where required for freestanding equipment.
C. Fasteners for general use shall be corrosion resistant screws and hardware including cadmium and zinc plated items.

D. Fasteners for damp and wet locations shall be stainless steel screws and hardware.

E. Exterior finish shall be gray baked enamel for items exposed in finished locations except as otherwise indicated.

F. Painted interior finish, where indicated, shall be white baked enamel.

G. Fittings for boxes, cabinets, and enclosures shall be in accordance with UL 5148 and shall be zinc plated steel for conduit hubs, bushings and box connectors.

2.6 UNDERGROUND PULL/JUNCTION BOXES

A. Unless noted otherwise, underground enclosures shall be fiberglass, open-bottom and sloped-wall. Covers shall be polymer concrete. Boxes shall be installed in areas expected to experience only light incidental, non-deliberate vehicular traffic (including that from mowers).

B. Enclosures shall meet the load requirements and three-point test procedures specified in the industry standard ANSI SCTE 77 2007. Enclosures shall meet the Tier 8 cover load test (for light traffic) of 12,000 lbs. over a 10" x 10" plate.

C. Manufacturer’s guidelines shall be followed for installation, including 6" gravel bed beneath box for stability and drainage. Concrete collar shall be poured around enclosure to protect the ring and top from impact due to soil erosion.

D. Manufacturer:
   1. Highline Products
   2. OZ-Gedney

PART 3 - EXECUTION

3.1 INSPECTION

A. The location of all wall outlets, including light fixtures, receptacles, switches, etc., shall be checked to see that the outlet will clear any wall fixture, shelving, work tables, sinks, baseboard and fin type convectors, bulletin boards, etc., that will be installed.

B. Exact locations of outlet boxes shall be coordinated with other trades so that outlet will not be covered by ductwork, piping, etc.

C. The approximate locations of outlets are indicated on the Drawings. The exact locations shall be determined at the building. The right is reserved to change, without additional cost, the exact location of any outlet, a maximum of 10' before it is permanently installed.

3.2 PREPARATION

A. Architectural Placement: Outlets occurring in architectural features shall be accurately centered in same. Space wall switch outlets equidistant from door trims on the strike side
of doors as actually installed so that coverplate clears trim. Orientation of outlet boxes (horizontal or vertical) shall be as indicated on architectural elevations.

B. Install all outlet boxes in finished areas flush with wall or ceiling finish. Maintain 1/4" or less space between outlet box front and finish wall surface.

C. All switches at same level shall be installed on one horizontal line as shown on the Drawings.

D. Wall mounted controls, including temperature controls, in a room shall be grouped at the same location and at same mounting heights.

3.3 INSTALLATION

A. At all concealed outlets for electric lights, switches, wall receptacles, etc., standard outlet boxes and plaster rings shall be provided.

B. Outlet boxes shall be firmly anchored in place and shall be provided with approved fixture studs where required. Outlet boxes shall not depend on the coverplate to hold it secure to the wall.

C. Boxes on opposite sides of walls or partitions: Where drawings show back-to-back wiring devices, the devices on opposite sides of the wall shall be offset a minimum of 6". Through-the-wall type boxes shall not be used. Where boxes will be located on opposite sides of walls or partitions located 24" or closer to each other, moldable putty pads shall be installed to completely cover the exterior surfaces of the box within the stud cavity with a ball of putty material used to plug the end of each conduit at its connection to the box.

D. All holes cut through new or existing smoke or fire partitions shall be sealed. Sealant shall be 3M Brand Fire Barrier System or approved equal. Seals shall be installed in accordance with manufacturer’s recommendations.

E. All flush boxes in rated walls that are larger than 16 square inches in area shall be backed as follows: 1-hour wall - 1 layer of 5/8" gypsum board; 2-hour rated wall - 2 layers of 5/8" gypsum board. Gypsum shall be fire code and attached to outside surfaces of box(es).

F. Cast aluminum, threaded hub type boxes with gasketed weatherproof covers shall be used for wet locations where box is surface mounted.

G. Location of floor boxes indicated is approximate. The Contractor shall refer to the final furniture layout or request field instructions for the exact location. Consult the Architect prior to installation.

END OF SECTION
PART 1 - GENERAL

1.1 GENERAL REQUIREMENTS

A. All work specified herein shall be accomplished in accordance with the applicable requirements of Section 16000 - Electrical General.

1.2 WORK INCLUDED

A. The work under this section shall include all labor, materials, accessories, services and equipment necessary to furnish and install wiring devices, complete, as indicated on the Drawings and as specified herein.

B. Equipment schedules and specifications are based on the one manufacturer listed in the schedule. Other manufacturers of equal quality and performance may be submitted to the Engineer for review. The following manufacturers are allowed:

1. Hubbell
2. Pass & Seymour
3. Cooper
4. Leviton
5. Thomas & Betts/Steel City
6. Walker/Wiremold

When substitution of equipment is made, the Contractor shall be responsible for the costs of any item and engineering and construction revisions necessary in his or any other contract or trade that may be required to satisfy plans and specifications.

C. This section includes receptacles, connectors, switches, dimmers, timeclocks and coverplates.

1.3 QUALITY ASSURANCE

A. Wiring devices shall comply with applicable sections of NEMA Standard WD-1, NFPA 70, Article 100.

B. All special purpose receptacles shall be NEMA standard configuration.

C. Comparative devices by acceptable manufacturers are equal.

PART 2 - PRODUCTS

2.1 WIRING DEVICE DESCRIPTION AND MANUFACTURER

A. Single & Duplex Receptacles (20 Amp)

1. Single or duplex type receptacle as indicated. 125V/20/A/2P/3W/G rating - NEMA - 5-20R type.
2. Face color shall be as specified by the Architect.
3. Manufacturer

   a. Hubbell 5362
B. GFCI Duplex Receptacles

1. Duplex, feed-thru type ground fault current interrupter receptacle with test/reset buttons. 125V/20A/2P/3W/G rating - NEMA 5-20R type conforming to UL #498, UL #943 Class A and NEMA #WD1-4.02.
2. Manufacturer
   a. Hubbell GF20 Series

C. Isolated Ground Single & Duplex Receptacles

1. Single or duplex type receptacles as indicated. 125V/20A/2P/3W/IG rating - NEMA 5-20R type ground internally isolated from receptacle frame and ground pigtail or terminal screw.
2. Manufacturer
   a. Hubbell IG5352

D. Clock/Flat Screen Receptacles

2. Manufacturer
   a. Hubbell RR151CH Series

E. Maintained Contact Switches

1. Provide toggle operated switches SPST, DPST, 3-way or 4-way operation as indicated. 277V/20A rating, quiet type, maintained contact, and a green hexagonal ground screw or ground pigtail, and side wired.
2. Manufacturer
   a. Hubbell 1221 Series (Color to match receptacles).

F. Momentary Contact Switches

1. Provide toggle or key operated switches as indicated with single circuit, 3-position center-off operation. 277V/20A rating, quiet type, momentary contact, spring loaded switch, and green hexagonal ground screw or ground pigtail, back and side wired.
2. Manufacturer
   a. Hubbell HBL 155* (Color to match receptacle).

G. Maintained Contact Slider Type Switch (For Multi-Ganging with Dimmers)

1. Slide-operated switch (to match dimmer), single pole, 3-way or 4-way operation as indicated, 120/277V, 20A rating.
2. Manufacturer
   a. Leviton Monet Series
   b. Lutron Nova T Series
H. Slider Type Incandescent Dimmers

1. Slide operated AC incandescent solid state type dimmer with positive ON/OFF switching, integral surge protection, voltage stabilized output, RFI filtered and maximum lighting level adjustment. 120V/60Hz, unless noted otherwise, with lettering and/or nameplate as indicated. Dimmers shall have lowest profile available (wattage permitting).

2. Manufacturer
   a. Leviton  Monet Series
   b. Lutron  Nova T Series

I. Illuminated Toggle Switches

1. Single pole, 3-way or 4-way, as indicated, conforming to UL #20, NEMA #WDI-3.02 and F.S. #W-S-896E. 277V/20A rating, quiet type, maintained contact, and a green hexagonal ground screw or ground pigtail, back and side wired. Red colored toggle to glow when switch is on.

2. Manufacturer
   a. Hubbell  HBL 1221PL

J. Weather-Resistant Receptacles

1. All 15- and 20-amp receptacles installed in damp or wet locations shall be listed weather-resistant type.

2.2 COVERPLATE DESCRIPTION AND MANUFACTURER - COVERPLATES

A. Flush Mounted Interior Receptacle/Switch Coverplates

1. Single or multi-gang to match device type. Medium size (4-7/8" min.), standard depth, smooth finish with nylon material.

2. Color to match device color.

3. Coverplates in mechanical/electrical equipment rooms and high abuse areas shall be stainless steel, non-magnetic.

4. Manufacturer
   a. Hubbell  NPJ Series (nylon)
   b. Hubbell  SS Series (stainless steel)

B. Weatherproof Device Coverplates

1. Provide weatherproof “in use” cast aluminum lockable covers.

   a. Hubbell  WP Series
   b. Thomas & Betts  Russell Stoll Series
C. Multi-Outlet Raceway

1. Product Description
   a. Two-piece rectangular surface raceway of length as prescribed. Stainless steel type 304 housing complete with all bends, fittings, couplings, caps and mounting hardware.
   b. Single 15A/125V grounding outlets UL Labeled and full length ground wire.
   c. Outlets 18" on centers starting no less than 9" from end.
   d. Maximum of six outlets per circuit. Where two or more circuits are utilized the outlets shall be on alternate circuits.

2. Manufacturers
   a. Walker/Wiremold
   b. Hubbell

2.3 MISCELLANEOUS ITEMS

A. Time Switches

1. Electronic Astronomical Schedule Type
   a. 365 day scheduling, solid state, skip-a-day feature, daylight saving changeover, leap year adjusted with capacitor backup, DPDT-120V/20A rated contacts, light sensor input.
   b. Acceptable Manufacturer
      1) Tork DZS Series (channels as required)

B. Photoelectric Control Switches

1. Product Description
   b. Die-cast housing with adjustable sensor.

2. Manufacturers
   a. AMF/Paragon
   b. Tork 2100 Series

C. Lighting Contactor

1. Product Description
   a. Multi-pole contactor for switching branch circuit tungsten and ballast lighting and resistant heating loads.
   b. Number of poles as indicated (paralleling multiple contactors is acceptable), poles rated for 20 amperes @ 600V continuous duty.
   c. Mechanically held contactor with coil clearing contacts, operating coil voltage to match circuit characteristics.
   d. Housed in panelboard (if indicated).
D. Poke-thru Floor Devices

1. Product Description
   a. Refer to drawings for specific features.
   b. Device shall meet UL 514A requirements for scrubwater test standards.

2. Manufacturer
   a. Hubbell
   b. Walker/Wiremold
   c. Thomas & Betts/Steel City

PART 3 - EXECUTION

3.1 INSTALLATION

A. All dimmer circuits shall have dedicated neutrals.

B. Install decorative plates on switch, receptacle, and blank outlets when indicated.

C. Install devices and wall plates flush and level.

D. Coordinate the exact location of wiring devices with other trades and architectural features. Do not locate devices on two different architectural finishes such as half on wall tile and half on painted surface, unless noted otherwise.

E. Provide plaster rings in areas requiring them due to construction.

F. Where more than one device is indicated, arrange in gangs covered with one coverplate per manufacturer’s instructions.

G. Where dimmer(s) and switch(es) are shown adjacent to one another, switch(es) shall be a maintained contact switch matching dimmer style, so that a common, multi-gang faceplate can be used.

H. Provide 6" long ground wire from grounding lug to all switches and receptacles to a screw type bonding device on the conduit or outlet box.

END OF SECTION
PART 1 - GENERAL

1.1 GENERAL REQUIREMENTS

A. All work specified herein shall be accomplished in accordance with the applicable requirements of Section 16000 - Electrical General.

B. Provide the panelboards indicated on the Drawings complete with overcurrent protection devices and spaces.

C. This section includes panelboards and distribution panelboards and associated auxiliary equipment rated 600 V or less as shown on the drawings.

D. Refer to panel schedule and one-line power diagram on drawings for specific requirements of each panel.

1.2 WORK INCLUDED

A. The work under this section shall include all labor, materials, accessories, services and equipment necessary to furnish and install panelboards, complete, as indicated on the Drawings and as specified herein.

B. Equipment schedules and specifications are based on the one manufacturer listed in the schedule. Other manufacturers of equal quality and performance may be submitted to the Engineer for review. When substitution of equipment is made, the Contractor shall be responsible for the costs of any item and engineering and construction revisions necessary in his or any other contract or trade that may be required to satisfy plans and specifications.

1.3 QUALITY ASSURANCE

A. Panels shall be factory assembled.

B. Coordination: Coordinate installation with architectural and structural features, equipment installed under other sections of the Specifications and electrical equipment to ensure panel access and so that clearance minimums are provided.

C. Components and installation shall be in accordance with NFPA 70, "National Electrical Code," NEMA PBI, "Panelboards" and UL67 and UL50.

D. Panelboards and load centers shall be listed and identified for use with 75 degrees C rated conductors.

1.4 SUBMITTALS

A. Refer to Section 16000 - Electrical General for submittal requirements.
B. Manufacturers Product Data:

1. Submit material Specifications and installation data for products specified under Part 2 - Products to include:
   a. Overcurrent protection devices
   b. Panelboards

C. Shop Drawings: Submit shop drawings to indicate information not fully described by the product data to indicate compliance with the Contract Drawings.

1. Include electrical characteristics and ratings for each panelboard with dimensions, mounting, bus material, voltage, ampere rating, mains, poles and wire connection, and any accessories. Indicate method of ground bus attachment to enclosure.
2. Include bussing diagram indicating each bussing overcurrent protection device position.
3. Provide a schedule indicating overcurrent protection device type, trip and size, poles, frame type, interrupting capacity.

1.5 SHORT CIRCUIT AND COORDINATION STUDY

A. Overcurrent protective devices shall be selectively coordinated for distribution systems serving emergency and standby loads, as well as those serving multiple elevators, for faults with durations at 0.01 seconds.

B. Manufacturer of switchboards and panelboards shall provide a short circuit and coordination study for:

1. Distribution systems required to be selectively coordinated that contain circuit breakers.
2. Distribution systems containing breakers with adjustable trip settings.
3. Distribution systems requiring arc-flash analysis.

Where required for selective coordination purposes, the coordination study shall be included in the shop drawing submittals for the equipment.

1.6 ARC FLASH SAFETY


B. Arc Flash Hazard Analysis

1. Manufacturer of panelboards shall provide an arc flash hazard analysis for the electrical distribution system. Include this study in the shop drawing submittals for the equipment.
2. The arc flash hazard analysis shall be performed according to the IEEE 1584 equations that are presented in NFPA70E-2004, Annex D.
3. When appropriate, the short circuit calculations and the clearing times of the phase overcurrent devices will be retrieved from the short-circuit and coordination study model. Alternative methods shall be presented in the proposal.
4. The flash protection boundary and the incident energy shall be calculated and reported at all significant locations in the electrical distribution system (panelboards) where work could be performed on energized parts.

5. The arc flash hazard analysis shall include all MV, 575v, and 480v locations and locations in 240 volt and 208 volt systems rated 400 amps and above.

6. Safe working distances shall be specified for calculated fault locations based upon the calculated arc flash boundary considering an incident energy of 1.2 cal/cm².

7. The arc flash hazard analysis shall include calculations for maximum and minimum contributions of fault current magnitude. The minimum calculation shall assume that the utility contribution is at a minimum and shall assume a minimum motor load. Conversely, the maximum calculation shall assume a maximum contribution from the utility and shall assume motors to be operating under full-load conditions.

8. Arc flash computation shall include both line and load side of main breaker calculations, where necessary.

9. Arc flash calculations shall be based on actual overcurrent protective device clearing time. Maximum clearing time will be capped at 2 seconds based on IEEE 1584-2002 section B.1.2.

10. The report shall indicate incident energy and flash protection boundary calculations as follows:

   a. Arcing fault magnitude
   b. Device clearing time
   c. Duration of arc
   d. Arc flash boundary
   e. Working distance
   f. Incident energy
   g. Hazard risk category
   h. Recommendations for arc flash energy reduction

C. Arc Flash Warning Labels

1. Contractor shall field-install arc flash labels on equipment that includes the available incident energy and required personnel protective equipment (PPE).

2. The vendor shall provide a 3.5 in. x 5 in. thermal transfer type label of high adhesion polyester for each work location analyzed.

3. The label shall have an orange header with the wording, “WARNING, ARC FLASH HAZARD,” and shall include the following information:

   a. Location designation
   b. Nominal voltage
   c. Flash protection boundary
   d. Hazard risk category
   e. Incident energy
   f. Working distance
   g. Engineering report number, revision number and issue date

4. Labels shall be machine-printed, with no field markings.

5. Arc flash labels shall be provided in the following manner and all labels shall be based on recommended overcurrent device settings:

   a. For each 600, 480 and applicable 208 volt panelboards and disconnects, one arc flash label shall be provided.
6. Labels shall be field-installed by the engineering service division of the equipment manufacturer under the Startup and Acceptance Testing contract portion.

D. Arc Flash Training

1. The equipment vendor shall train personnel of the potential arc flash hazards associated with working on energized equipment (minimum of 4 hours). Maintenance procedures in accordance with the requirements of NFPA 70E, Standard for Electrical Safety Requirements for Employee Workplaces, shall be provided in the equipment manuals. The training shall be certified for continuing education units (CEUs) by the International Association for Continuing Education Training (IACET).

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Panelboard manufacturer shall be:

1. Siemens
2. Square D
3. General Electric
4. Cutler-Hammer

B. Coordination panelboard manufacturer (fusible panelboards) shall be:

1. Cooper Bussman

2.2 GENERAL REQUIREMENTS

A. All panels and overcurrent protection devices shall be UL Listed and bear a UL Label. Where panel serves as service entrance equipment, panel shall bear a UL Label indicating suitability as service entrance equipment.

B. Panels shall be of the dead front safety type.

C. Provide panels complete with factory assembled circuit breakers or fuses connected to the bus bars in the positions shown on the panel schedules.

D. Provide all panelboards fully rated to the A.I.C. ratings noted on the schedules, but not less than 10,000 amperes for 120/208 volt panelboards and not less than 14,000 amperes for 277/480 volt panelboards. All devices in a panelboard shall be rated for the A.I.C. ratings shown for the panelboard.

2.3 BUSSING AND INTERIORS

A. All bus bars shall be copper. Main lugs and main overcurrent protection devices shall be UL approved for copper or aluminum conductors and shall be of a size range for the conductors indicated on the drawings. Each panel shall contain a full size grounding bus. All panelboards shall contain a full size insulated neutral bus unless otherwise indicated on the drawings.
B. The neutral and ground bus shall have a sufficient number of lugs to singularly terminate each individual conductor requiring a connection.

C. Where designated on panel schedule as “space,” include all necessary bussing, device support and connections. Provide blank cover for each space.

D. Where specified or indicated on the drawings, provide sub-feed lugs adjacent to the mains or feed-through lugs opposite end of mains and increase box heights to provide additional cable bending and termination space. Lugs to be the same size and capacity as mains and rated for aluminum or copper conductor terminations.

2.4 ENCLOSURES

A. Panelboard width shall not be less than twenty inches unless indicated on the drawings (32” minimum for distribution panelboards).

B. Provide concealed captive clamping devices, concealed hinges and chrome lock for all flush mounted panels. Key all panels throughout project alike.

C. Where two section panels are required, both sections shall have fully rated bus, separate cabinets connected by conduit nipples. Interconnect sections with copper conductors with ampacity equal to rating of main bus. Route phase and neutral conductors together between panels. Provide separate trims for each section.

D. Panelboard trims for surface mounted panelboards shall be continuously hinged on one side so that when opened, wiring gutters are completely exposed.

E. Provide a label for each branch circuit, feeder, and main circuit breaker in distribution panels, permanently attached per the requirements of Section 16000 – Electrical General, 2.2A.

F. Cabinets, flush or surface mounted as indicated. NEMA PB-1, Type 1 enclosure, except where the following enclosure requirements are indicated:

1. NEMA 250, Type 3R - Raintight.
2. NEMA 250, Type 3S - Raintight and dust tight.
3. NEMA 250, Type 4X - Corrosion-resistant stainless steel enclosure, watertight, dust tight, and resistant to oil and coolant seepage. This type shall be used in kitchen areas.
4. NEMA 250, Type 12 - Dust tight, dripproof, and resistant to oil and coolant seepage.

G. Enclosure shall be fabricated with galvanized steel. Trims shall have electrostatic applied ANSI gray enamel finish and adjustable indicating trim clamps for securing trim to the enclosure. Screwed-on trims shall not be acceptable. Trim shall have an angle support along the bottom serving as a support between trim and enclosure for safe installation and removal of trim.

H. Exterior Panels: Panelboards mounted outside of building shall be in NEMA type 3R enclosures. Panelboards shall have in addition to the standard specified items the following:
1. Piano hinge
2. Seams continuously welded
3. Rolled lip around door and cabinet
4. No knockouts or holes
5. Neoprene gaskets on inside of door
6. Stainless steel hardware
7. Drip hood at top above door

2.5 CIRCUIT BREAKERS

A. Interrupting rating of all circuit breakers in panelboards shall have UL rating of not less than the RMS symmetrical amps indicated on the Drawings at system voltage. Series rated devices are acceptable with the following exceptions: devices used in distribution serving emergency, standby and multiple elevator loads (selective coordination).

B. Circuit breakers shall be provided with trip rating and poles as indicated on the drawings or specified herein.

C. Multi-pole breakers shall be common trip and common reset; tie handle connection between single pole breakers is not acceptable.

D. Branch circuit breakers in lighting and appliance panels shall be quick-make, quick-break, thermal magnetic type bolted to the bus. Circuit breakers in distribution type panel boards shall be bolted to the bus.

E. Provide the following special devices and accessories when indicated on the drawings or specified herein.
   1. Ground fault interrupting circuit breakers (GFI) where indicated on the drawings.
   2. Provide handle lock-on device (to prevent manually turning off device without removal) for all overcurrent devices where indicated on panelboard schedules, and for those protecting circuits serving fire alarm equipment, and for those dedicated for powering emergency battery-powered unit equipment.
   3. Provide UL Listed “SWD” switching duty circuit breakers on the devices indicated on the drawings.
   4. Provide shunt trip device for electrically tripping circuit breakers indicated on the drawings.
   5. Overcurrent protective devices for fire alarm circuits shall have handles that are factory-marked in the color red.

2.6 FUSIBLE COORDINATION PANELBOARDS

A. Interrupting rating of all fuses in panelboards shall have UL rating of not less than the RMS symmetrical amps indicated on the Drawings at system voltage.

B. Fusible panelboards shall be listed to UL 67.

C. Furnish 10% or minimum of three fuses of each rating and type of fuse installed, in addition to any spares indicated in schedule.

D. Panelboard overcurrent device interrupting ratings shall be fully rated for the maximum available fault current and have a U.L. listed interrupting rating of 300kA and CSA certified interrupting rating of 200kA.
E. Panelboard circuits 100A and less shall incorporate overcurrent protection and branch-circuit disconnecting means into a single integrated component.

F. Interiors shall be factory assembled.

G. Panelboard shall be equipped with a six-space spare fuse compartment for storing replacement branch circuit fuses.

H. Bus bars shall be tin-plated copper.

I. Neutrals shall be fully rated.

J. Where equipped with main disconnect, permanently installed lockout means shall be provided on the disconnect for lockout tag procedures.

K. Main disconnect shall be quick-make, quick-break type.

L. Main and Branch Overcurrent Protection
   1. All overcurrent protective devices shall have a minimum U.L. listed interrupting rating of 300kA and CSA Certified interrupting rating of 200kA.
   2. Main overcurrent protective devices shall be 600Vac UL Listed minimum 300kA IR and CSA Certified minimum 200kA IR Class J time-delay fuses or Class J performance fuses.
   3. Branch circuit overcurrent protection shall be 600Vac UL Listed minimum 300kA IR and CSA Certified minimum 200kA IR finger-safe fuse with Class J performance fuses.
   4. Where panelboard main fuses are installed, fuses in panelboard branch circuits shall selectively coordinate with main fuses for all overcurrents up to 200kA.

M. Branch fused disconnects
   1. Device shall have visible ON/OFF indication with colored and international symbol markings.
   2. Device shall provide open fuse indication permanently installed neon indicating light.
   3. Device shall be UL and cUL Listed 600Vac/200kA or 125Vdc/100kA voltage/short-circuit current rating, load-break disconnect with amp ratings and number of poles as indicated on the panelboard schedule.
   4. Fuse and disconnect assembly shall be a finger-safe component with trim installed.
   5. Fuse and disconnect shall be interlocked to disallow fuse removal while fuse terminals are energized.
   6. No special tools shall be required for fuse removal.
   7. Devices shall have bolt-on style bus connectors.
   8. Device housing shall be clearly marked with device amperage.
   9. Device shall provide fuse amp rating rejection at the following ampacities to ensure continued circuit protection at the specified circuit rating: 15A, 20A, 30A, 40A, 50A, 60A, 70A, 90A and 100A.
PART 3 - EXECUTION

3.1 INSTALLATION

A. Provide from each flush mounted panelboard four (4) 3/4" empty conduits stubbed out above ceiling line and capped.

B. Install panelboards in accordance with NEMA PB1.1, “General Instructions for Proper Installation, Operation and Maintenance of Panelboards Rated 600 Volts or Less” and manufacturer’s written installation instructions.

C. Mount panelboards with top circuit breaker not more than 6'-6" above finished floor.

D. Only one conductor installed under terminal of individual circuit breakers. Form and train conductors in panel enclosure neatly parallel and at right angles to sides of box. Un-insulated conductor shall not extend beyond one-eighth inch from terminal lug.

E. Do not splice conductors in panels. Where required, install junction box adjacent to panel and splice or tap conductors in box.

F. Mounting and Support

1. Mounting
   a. Enclosure shall be secured to structure by a minimum of four (4) fastening devices. Panelboards 600 amp and larger shall be secured by a minimum of eight (8) devices. A 1.5 inch minimum diameter round washer shall be used between head of screw or bolt and enclosure.
   b. Enclosures shall be mounted where indicated on the drawings or specified herein. Support from the structure with fastening device specified.
   c. Attach enclosure directly to masonry, concrete, or wood surfaces.
   d. Mounted enclosure on metal channel (strut), which is connected to structure with fastening device specified, for installation on steel structure or sheet rock walls.

G. Maintain conductor phase color code requirements described in the conductors and cables section of the specifications.

H. A typewritten branch circuit directory (based on as-built conditions) shall be provided for each panelboard and load center, permanently mounted on inside of door in a transparent, protective cover. Room number(s) or room name(s) shall be included in the circuit description in coordination with the final naming/numbering scheme for the project (e.g. “Office Receptacles” shall read “Office Receptacles – Rm. 202, 203”).


J. Tighten electrical connectors and terminals, including grounding connections, in accordance with manufacturer’s published torque-tightening values. Where manufacturer’s torque values are not indicated, use those specified in UL 486A and UL 486B.
K. Mounting of all panelboards and all hardware used for mounting shall be in accordance with the seismic criteria per the applicable building code.

L. Fusible coordination panelboards shall be shipped without branch circuit fuses installed. Branch circuit fuses shall be shipped separately with the chassis. Where main fuses are specified 100A or greater, equipment shall be shipped with main fuses installed.

END OF SECTION
PART 1 - GENERAL

1.1 GENERAL REQUIREMENTS

A. All work specified herein shall be accomplished in accordance with the applicable requirements of Section 16000 - Electrical General.

1.2 WORK INCLUDED

A. The work under this section shall include all labor, materials, accessories, services and equipment necessary to furnish and install disconnect switches, up to 1200 amps, complete, as indicated on the Drawings and as specified herein.

B. Equipment schedules and specifications are based on the one manufacturer listed in the schedule. Other manufacturers of equal quality and performance may be submitted to the Engineer for review. When substitution of equipment is made, the Contractor shall be responsible for the costs of any item and engineering and construction revisions necessary in his or any other contract or trade that may be required to satisfy plans and specifications.

C. This section includes fuses.

D. This section includes individually mounted enclosed switches used for the following:
   1. Service disconnecting means.
   2. Feeder and branch-circuit protection.

1.3 SUBMITTALS

A. Product Data: For each type of switch and fuse accessory, and component indicated, include dimensions and manufacturer’s technical data on features, performance, electrical characteristics, ratings, and finishes.

1.4 QUALITY ASSURANCE

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

B. Comply with NEMA AB 1, NEMA KS 1 and UL 98.

C. Comply with NFPA 70.

D. Comply with NEMA FU 1.

E. Source Limitations: Provide fuses from a single manufacturer.

1.5 COORDINATION

A. Coordinate layout and installation of switches and components with other construction, including conduit, piping, equipment, and adjacent surfaces. Maintain required workspace clearances and required clearances for equipment access doors and panels.
PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturer of fusible and non-fusible switches shall be Cutler-Hammer, General Electric, Siemens or Square D Company.

B. Manufacturer of fuses shall be Bussman, Gould Shawmut or Littelfuse.

2.2 ENCLOSED SWITCHES

A. All disconnect switches shall be heavy duty type with lockable handles.

B. Enclosed, non-fusible switch: NEMA KS 1.

C. Enclosed, fusible switch, 800 A and smaller: NEMA KS 1 with clips to accommodate specified fuses and interlocked with cover in closed position.

D. Furnish and install all safety type disconnecting switches indicated on the drawings, specified or required by the National and/or State Electrical Code. Switches shall be externally operable. If the size is not shown on the drawings, the subcontractor shall size the disconnect switch in accordance with name plate data of the equipment they serve.

E. Coordinate with other trades that may provide unit mounted disconnect switches prior to submission of bids.

F. Safety type disconnecting switches shall be heavy duty, 600 volt industrial type with quick-make, quick-break mechanism and interlocking cover which normally cannot be opened when the switch is in the "ON" position. Switches shall be single throw. Fusible switches shall be equipped with fuse clips to receive Bussman fuses. Switches shall have provision for padlocking in the open and closed positions. The operating handle shall be visible in either the on or off position.

G. All fused disconnect switches mounted above 6'-6" shall be hook stick operable.

2.3 INTERIOR

A. Switch blades shall be operated by rotating shaft directly connected to the operating handle mechanism. Switch blades shall be clearly visible in the open position. All switches shall have clear shields over the incoming line lugs. Line shields shall be attached in such a way that switch blade covers or arc shields need not be removed for line installation. Line and load lugs shall be front removable and suitable for copper or aluminum, 60/75 degree wire through 200A sizes, 75 degrees C wire for 400-800A sizes.

B. Current limiting type RK1 dual element time delay fuses shall be furnished and installed as necessary; rating shall be shown on drawing.

2.4 ENCLOSURES

A. All switches shall have NEMA type 1 general purpose enclosures unless indicated otherwise on the drawings. NEMA 3R covers shall be side hinged rather than top hinged. NEMA 1 and 3R switches through 200A sizes shall tangential knockouts for conduit line up against walls. NEMA 12 enclosures through 200A sizes shall be UL Listed for
conversion to NEMA 3R usage by opening a factory provided drain hole. All types of enclosures shall have metal nameplates affixed to the cover to show the switch type and rating and clearly indicate “ON” and “OFF” direction of handle movement. Provide hubs on all NEMA 4, 4X, or 3R type disconnects.

B. Provide manufacturer’s standard factory applied finish unless otherwise indicated.

C. Provide phenolic engraved nameplate for disconnect switches.

2.5 CONTROL POLE

A. Where required a direct action interlock or control pole shall be affixed to the switch base in such a manner as to operate positively and only with the opening and closing of the switch power poles.

2.6 CARTRIDGE FUSES

A. Characteristics: NEMA FU 1, nonrenewable cartridge fuse; class and current rating indicated; voltage rating consistent with circuit voltage.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine utilization equipment nameplates and installation instructions. Install fuses of sizes and with characteristics appropriate for each piece of equipment.

B. Examine elements and surfaces to receive enclosed switches for compliance with installation tolerances and other conditions affecting performance. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Locate disconnect switches to provide working clearance and full accessibility as required by the National Electrical Code.

B. Mounting and Support

1. Mounting

   a. Enclosure shall be secured to structure by a minimum of four (4) fastening devices. A 1.5-inch minimum diameter round washer shall be used between head of screw or bolt and enclosure.

   b. Enclosure shall be mounted where indicated on the drawings or specified herein. Support from the structure with fastening device specified. Mount with operating handle at 60” AFF, unless other height is indicated.

   c. Attach enclosure directly to masonry, concrete, or wood surfaces.

   d. Mounted enclosure on metal channel (strut), which is connected to structure with fastening device.

   e. Where enclosure is not indicated on a wall or structure, construct a metal channel (strut) free standing frame secured to floor, pad, or other appropriate building structure.
C. Do not splice conductors in enclosure. Where required install junction box or wireway adjacent to enclosure and splice or tap conductors in box. Refer to number of conductors in a conduit limitation defined in the conductors and cables section of the Specifications and do not exceed.

3.3 CONNECTIONS

A. Install equipment grounding connections for switches with ground continuity to main electrical ground bus.

B. Tighten electrical connectors and terminals according to manufacturer’s published torque-tightening values. If manufacturer’s torque values are not indicated, use those specified in UL 486A and UL 486B.

3.4 CLEANING

A. On completion of installation, inspect interior and exterior of enclosures. Remove paint splatters and other spots. Vacuum dirt and debris; do not use compressed air to assist in cleaning.

B. Touch up paint all scratched or marred surfaces with factory furnished touch up paint of the same color as the factory applied paint.

END OF SECTION
PART 1 - GENERAL

1.1 DESCRIPTION
A. Provide an emergency standby power system for supply of power in the event of failure of normal supply, consisting of a liquid cooled engine, an AC alternator and system controls with all necessary accessories for a complete operating system, including but not limited to the items as specified hereinafter. System shall comply with NFPA 110 requirements, and the latest requirements of the U.S. Environmental Protection Agency (EPA).

B. Generator shall be rated as indicated on drawing at 30% maximum voltage dip.

C. Provide automatic operation from automatic transfer switch(es) described within this specification so that the system comes on line fully automatically, and after restoration of utility automatically retransfers load to normal power, shuts down the generator and returns to readiness for another operating cycle.

1.2 CODES AND STANDARDS
A. The emergency generator system shall conform to the requirements of the following:
   1. NFPA 110 – Emergency and Standby Power Systems
   2. NFPA 30 – Flammable and Combustible Liquids Code
   3. NFPA 37 – Standard for Installation and Use of Stationary Combustion Engines and Gas Turbines

1.3 MANUFACTURER QUALIFICATIONS
A. This system is designed based upon products of Generac. Caterpillar/Olympian, Cummins/Onan, and MTU/Detroit Diesel are considered to be approved equals provided they meet every portion of this written specification. The manufacturer must be regularly engaged in the production of engine-alternator sets and associated controls for a minimum of ten years, so there is one source of supply and responsibility. The complete engine generator set system shall be supplied by the manufacturer’s authorized distributor only.

PART 2 - PRODUCTS

2.1 ENGINE
A. The prime mover shall be a liquid cooled, natural gas turbo-charged/after cooled engine of 4-cycle design. The engine shall be a single piece, cast block. Multiple blocks combined are not acceptable. The engine will utilize in-cylinder combustion technology, as required, to meet the applicable EPA NSPS rule for stationary reciprocating compression ignition engines. Additionally, the engine shall comply with the State Emission regulations at the time of installation/commissioning. Actual engine emissions values must be in compliance with applicable EPA emissions standards per ISO 8178-D2 Emissions Cycle at specified ekW/bHP rating. Utilization of the “Transition Program for Equipment Manufacturers” (also known as “Flex Credits”) to achieve EPA certification is not acceptable. The in-cylinder engine technology must not permit unfiltered exhaust gas to be introduced into the combustion cylinder.
B. The engine is to be cooled with a unit-mounted radiator, fan, water pump, and closed coolant recovery system providing visual diagnostic means to determine if the system is operating with a normal engine coolant level. The radiator shall be designed for operation in 104 degrees Fahrenheit (40 degrees Celsius) ambient temperature.

C. The intake air filter with replaceable element must be mounted on the unit. Full pressure lubrication shall be supplied by a positive displacement lube oil pump. The engine shall have a replaceable oil filter with internal bypass and replaceable elements. Engine coolant and oil drain extension must be provided to outside the mounting base for cleaner and more convenient engine servicing. A fan guard must be installed for personnel safety.

D. The engine shall have a battery charging DC alternator with a transistorized voltage regulator. Remote 2-wire starting shall be by a solenoid shift, electric starter.

E. Engine speed shall be governed by an electronic governor to maintain alternator frequency within 0.5% from no load to full load alternator output. Steady state regulation is to be + or - 0.25%.

F. The engine fuel system shall be designed for operation on natural gas having a BTU content of 1000 BTU per cubic foot. A carburetor, secondary regulator, fuel lock-off solenoid and all piping must be installed at the point of manufacturing, terminating at a single pipe opening external to the mounting base. Pressure required is 7 - 16 inches water column, or .35-.50 psi when generator is operating at 100% load. For gensets above 150 kW, pressure required is 1.5 psi minimum, 5 psi maximum.

G. Sensing elements to be located on the engine for low oil pressure shutdown, high coolant temperature (low coolant level shutdown), overspeed shutdown, overcrank shutdown. These sensors are to be connected to the control panel using a wiring harness with the following features: wire number labeling on each end of the wire run for easy identification, a molded rubber boot to cover the electrical connection on each sensor to prevent corrosion and all wiring to be run in flexible conduit for protection from the environment and any moving objects.

H. The engine shall have an engine-mounted, thermostatically-controlled jacket water heater to aid in quick starting. It will be of adequate wattage as recommended by the engine manufacturer. The Contractor shall provide proper branch circuit from normal utility power source.

2.2 ALTERNATOR

A. The alternator shall be a 4-pole revolving field type, for 3-phase, 60 Hz (voltage indicated on Drawings) with a brushless exciter. The stator shall be directly connected to the engine flywheel to ensure permanent alignment. The generator shall meet temperature rise standards for UL 1446 Class H or better varnish. All leads must be extended into the AC connection panel. The alternator shall be protected by an automatic reset field circuit breaker, or over excitation sensing voltage regulator.

B. Load acceptance shall be 100% of nameplate kW rating and meet the requirements of NFPA 110. The engine-generator set shall be so designed that instantaneous voltage dip upon application of nameplate kW/kVA shall not exceed 30% with recovery to stable operation within 10 seconds. Sustained voltage dip data is not acceptable.
C. A solid state voltage regulator designed and built by the engine-generator set manufacturer must be used to control output voltage by varying the exciter magnetic field to provide + or - 1% regulation during stable load conditions. Should an extremely heavy load drop the output frequency, the regulator shall have a voltage drop of 4 volts/hertz to maximize motor starting capability. The frequency at which this drop operation begins must be adjustable, allowing the generator set to be properly matched to the load characteristics ensuring optimum system performance.

D. The voltage regulator must contain a limiting circuit to prevent output voltage surges in excess of 110% of rated voltage during generator set operation. On a loss of the sensing signal, the voltage regulator must shutdown to prevent an overvoltage condition from occurring. A voltage regulator that can go into a full field condition is unacceptable. A rheostat shall provide a minimum of + or - 10% voltage adjustment from the rated value.

E. A NEMA 1 panel that is an integral part of the generator set must be provided to allow the installer a convenient location in which to make electrical output connections. An isolated neutral lug must be included by the generator set manufacturer to ensure proper sizing.

F. The electric plant shall be mounted with vibration isolators on a welded steel base which shall permit suitable mounting to any level surface.

G. Terminal lugs shall be factory-installed for load-side feeder connections.

2.3 CONTROLS

A. All engine alternator controls and instrumentation shall be designed, built, wired, tested and shock mounted in a NEMA 1 enclosure to the engine-generator set by the manufacturer. It shall contain panel lighting and a fused DC circuit to protect the controls. It shall provide true RMS sensing to ensure AC metering accuracy to within +/- 1% of rated AC voltage (L-L and L-N) and current.

B. The engine-generator set shall contain a complete engine start-stop control which starts the engine on closing contacts and stops the engine on opening contacts. A cyclic cranking limiter shall be provided to open the starting circuit after five attempts if the engine has not started within that time. Engine control modules must be solid state plug-in type for high reliability and easy service. The engine controls shall also include a 3-position selector switch with the following positions: RUN/AUTO/STOP. A red annunciator lamp shall be energized when the switch is not in auto.

C. Safety shutdown monitoring system shall include solid state engine monitor with individual lights and one common external alarm contact indicating the following conditions: Overcrank shutdown, Overspeed shutdown, High Coolant Temperature (Low Coolant Level shutdown), Low Oil Pressure shutdown. Monitoring system shall include lamp test switch or engine control switch for manual reset of tripped conditions. Engine RPM is to be monitored by an independent permanent magnet sensor. If there is a failure in this circuit, the engine must shut down immediately and illuminate an overspeed condition.

D. Engine control panel instrumentation shall consist of an oil pressure gauge, coolant temperature gauge, DC ammeter and an engine run hour meter located on the unit control panel. Alternator instrumentation must include analog or digital meters to indicate output voltage, amperage, kW, kVA, PF and frequency.
E. Provide the following items installed at the factory:

1. Pre-alarms for low coolant temperature, high water temperature and low oil pressure must be provided to anticipate possible problems before the system becomes inoperative. Yellow lights labeled on the control panel will illuminate should the associated parameter be exceeded.
2. Engine battery voltage is to be monitored to detect abnormal voltage levels. A light labeled on the control panel will illuminate should a low voltage condition be experienced.
3. One alarm horn to actuate upon engine fault shutdown.
4. Emergency stop button to immediately shut down the engine upon actuation.

2.4 MISCELLANEOUS EQUIPMENT

A. The following equipment is to be installed at the engine-generator set manufacturer’s facility:

1. Exhaust silencer(s) shall be provided of the size as recommended by the manufacturer and shall be critical grade. The silencer(s) shall have a flexible, seamless, stainless steel exhaust connection and rain cap. All components must be properly sized to assure operation without excessive back pressure when installed.
2. Provide an automatic dual rate battery charger manufactured by the engine-generator set supplier. The automatic equalizer system shall monitor and limit the charge current to 10 amps. The automatic battery charger shall be rated no less than 10 amps. The charger must have a maximum open circuit voltage of 35 volts and be protected against a reverse polarity connection. The battery charger is to be factory installed on the generator set. Due to line voltage drop concerns, a battery charger mounted in the transfer switch will be unacceptable.
3. A heavy duty, lead acid battery set shall be provided by the generator set manufacturer of adequate voltage and amperage capacity to start and operate the engine. Provide all intercell and connecting battery cables as required.
4. Weather Protective Sound Attenuated Enclosure: The engine-generator set shall be factory enclosed in a heavy gauge steel sound attenuated enclosure constructed with a 90 degrees radiator air discharge plenum, corner posts and powder coated baked finish. The enclosure is to have large, easily opened doors to allow access to the engine, alternator and control panel. Each door is to be fitted with stainless steel, lockable hardware with identical keys. Padlocks do not meet this specification. The maximum sound level shall be rated 75dBA @ 23 feet.

B. The following equipment is to be provided by the engine-generator set manufacturer and shipped loose with the unit:

1. Provide a remote annunciator panel for wall mounting. The panel shall have an ALARM switch that when activated silences the audible alarm. A TEST switch must be included to verify the lights are functional. The following alarms shall be included for the remote annunciator:
   a. Overcrank
   b. Low Coolant/Water Temperature
   c. High Coolant/Water Temperature Pre-Alarm
   d. High Coolant/Water Temperature Shutdown
   e. Low Oil Pressure Pre-Alarm
f. Low Oil Pressure Shutdown  
g. Overspeed  
h. Low Fuel Alarm  
i. Control Switch Not In Auto  
j. Provide a minimum of four (4) spare lights for other potential alarms.

2. Provide a manual breakglass station located on the weatherproof enclosure for shutdown of the generator. Station shall be appropriately labeled.

PART 3 - AUTOMATIC TRANSFER SWITCH

3.1 SCOPE

A. Furnish and install the 3-pole automatic transfer switch(es) with amperage, voltage, and withstand rating as shown on the plans. Each automatic transfer shall consist of a double throw power transfer switch mechanism and a microprocessor controller to provide automatic operation. All transfer switches and controllers shall be the products of the same manufacturer.

3.2 CODES AND STANDARDS

A. The automatic transfer switch(es) and controls shall conform to the requirements of:

1. UL 1008 – Standard for Transfer Switch Equipment  
2. IEC 947-6-1 Low-voltage Switchgear and Control gear; Multifunction equipment; Automatic Transfer Switching Equipment  
3. NFPA 70 – National Electrical Code  
4. NFPA 110 – Emergency and Standby Power Systems  
5. IEEE Standard 446 – IEEE Recommended Practice for Emergency and Standby Power Systems for Commercial and Industrial Applications  
7. UL 508 Industrial Control Equipment

3.3 ACCEPTABLE MANUFACTURERS

A. Automatic transfer switch(es) shall be based on ASCO 7000 Series. Other acceptable manufacturers shall be Russell.

3.4 MECHANICALLY HELD TRANSFER SWITCH

A. The transfer switch shall be electrically operated and mechanically held. The electrical operator shall be a momentarily energized, single-solenoid mechanism. Main operators which include overcurrent disconnect devices, linear motors or gears shall not be acceptable. The switch shall be mechanically interlocked to ensure only two possible positions, normal or emergency.

B. Inspection of all contacts shall be possible from the front of the switch without disassembly of operating linkages and without disconnection of power conductors. Switches rated 600 amps and higher shall have front removable and replaceable contacts. All stationary and moveable contacts shall be replaceable without removing power conductors and/or bus bars.
C. Designs utilizing components of molded-case circuit breakers, contactors, or parts thereof, which are not intended for continuous duty, repetitive switching or transfer between two active power sources are not acceptable.

D. A neutral conductor plate with fully rated AL-CU pressure connectors shall be provided.

3.5 MICROPROCESSOR CONTROLLER

A. The controller’s sensing and logic shall be provided by a single built-in microprocessor for maximum reliability, minimum maintenance, and the ability to communicate serially through an optional serial communication module.

B. All customer connections shall be wired to a common terminal block to simplify field-wiring connections.

C. The controller shall meet or exceed the requirements for Electromagnetic Compatibility (EMC) as follows:

   1. IEEE472 (ANSI C37.90A) Ring Wave Test
   2. ENC55011 1991 Class A Conducted and Radiated Emission
   3. EN61000-4-2 Electrostatic Discharge Immunity, Direct Contact & Air Discharge
   4. EN61000-4-3 Radiated Electromagnetic Field Immunity
   5. EN61000-4-4 Electrical Fast Transient Immunity
   6. EN61000-4-5 Surge Immunity
   7. ENV50141 HF Conducted Disturbances Immunity

3.6 ENCLOSURE

A. The ATS shall be furnished in a NEMA type 1 enclosure unless otherwise shown on the plans.

3.7 STANDARD FEATURES

A. A three position momentary-type test switch shall be provided for the test/automatic/reset modes. The test position will simulate a normal source failure. The reset position shall bypass the time delays on either transfer to emergency or retransfer to normal.

B. A set of DPDT gold-flashed contacts rated 10 amps, 32 VDC shall be provided for a low-voltage engine start signal. The start signal shall prevent dry cranking of the engine by requiring the generator set to reach proper output, and run for the duration of the cool down setting, regardless of whether the normal source restores before the load is transferred.

C. Auxiliary contacts, rated 10 amps, 250 VAC shall be provided consisting of one contact, closed when the ATS is connected to the normal source and one contact closed, when the ATS is connected to the emergency source.

D. LED indicating lights (16 mm industrial grade, type 12) shall be provided; one to indicate when the ATS is connected to the normal source (green) and one to indicate when the ATS is connected to the emergency source (red).
E. LED indicating lights (16 mm industrial grade, type 12) shall be provided and energized by controller outputs. The lights shall provide true source availability of the normal and emergency sources, as determined by the voltage sensing trip and reset settings for each source.

F. An inphase monitor shall be provided in the controller. The monitor shall control transfer so that motor load inrush currents do not exceed normal starting currents, and shall not require external control of power sources. The inphase monitor shall be specifically designed for and be the product of the ATS manufacturer. The inphase monitor shall be equal to ASCO Feature 27.

G. Engine Exerciser: The controller shall provide an internal engine exerciser. The engine exerciser shall allow the user to program up to seven different exercise routines. For each routine, the user shall be able to:

1. Enable or disable the routine.
2. Enable or disable transfer of the load during routine.
3. Set the start time,
   - time of day
   - day of week
   - week of month (1st, 2nd, 3rd, 4th, alternate or every).
4. Set the duration of the run.

At the end of the specified duration the switch shall transfer the load back to normal and run the generator for the specified cool down period. A 10-year life battery that supplies power to the real time clock in the event of a power loss will maintain all time and date information.

H. System Status: The controller LCD display shall include a “System Status” screen which shall be readily accessible from any point in the menu by depressing the “ESC” key a maximum of two (2) times. This screen shall display a clear description of the active operating sequence and switch position. For example,

Normal Failed
Load on Normal
TD Normal to Emerg
2min15s

Controllers that require multiple screens to determine system status or display “coded” system status messages, which must be explained by references in the operator’s manual, are not permissible.

I. Data Logging: The controller shall have the ability to log data and to maintain the last 99 events, even in the event of total power loss. The following events shall be time and date stamped and maintained in a non-volatile memory:

1. Event Logging
   a. Data and time and reason for transfer normal to emergency
   b. Data and time and reason for transfer emergency to normal
   c. Data and time and reason for engine start
   d. Data and time engine stopped
   e. Data and time emergency source available
   f. Data and time emergency source not available
2. Statistical Data
   a. Total number of transfers
   b. Total number of transfers due to source failure
   c. Total number of days controller is energized
   d. Total number of hours both normal and emergency sources are available

3.8 ACCESSORIES

A. Provide two double throw contacts that operate when emergency source voltage is present at the switch terminals, ASCO accessory 18B.

B. Provide two double throw contacts that operate when normal source voltage is present at the switch terminals, ASCO accessory 18G.

C. Provide a selective load disconnect circuit (Elevator Contacts) that operates with an adjustable time delay from 1 second to 5 minutes before transfer of the ATS to emergency and resets 1 second to 5 minutes after the retransfer to normal, ASCO accessory 31Z.

D. Provide digital metering for local and remote (MODBus) annunciation, ASCO accessory 85L, with the following metered quantities:
   1. Current, per phase RMS and neutral (if applicable)
   2. Current Unbalance %
   3. Voltage, phase-to-phase and phase-to-neutral
   4. Voltage Unbalance %
   5. Real power, per phase and 3-phase total
   6. Apparent power, per phase and 3-phase total
   7. Reactive power, per phase and 3-phase total
   8. Power factor, 3-phase total and per phase
   9. Frequency
   10. Accumulated Energy (MWH, MVAH, and MVARH)

3.9 CONTROLLER DISPLAY AND KEYPAD

A. A 4-line, 20-character LCD display and keypad shall be an integral part of the controller for viewing all available data and setting desired operational parameters. Operational parameters shall also be available for viewing and limited control through the serial communications input port. The following parameters shall only be adjustable via DIP switches on the controller:
   1. Nominal line voltage and frequency
   2. Single or three phase sensing
   3. Operating parameter protection
   4. Transfer operating mode configuration
      (Open transition, Closed transition, or Delayed transition)

All instructions and controller settings shall be easily accessible, readable and accomplished without the use of codes, calculations, or instruction manuals.
### 3.10 VOLTAGE, FREQUENCY AND PHASE ROTATION SENSING

A. Voltage and frequency on both the normal and emergency sources (as noted below) shall be continuously monitored, with the following pickup, dropout, and trip setting capabilities (values shown as % of nominal unless otherwise specified):

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Sources</th>
<th>Dropout/Trip</th>
<th>Pickup/Reset</th>
</tr>
</thead>
<tbody>
<tr>
<td>Undervoltage</td>
<td>N&amp;E,30</td>
<td>70 to 98%</td>
<td>85 to 100%</td>
</tr>
<tr>
<td>Overvoltage</td>
<td>N&amp;E,30</td>
<td>102 to 115%</td>
<td>2% below trip</td>
</tr>
<tr>
<td>Underfrequency</td>
<td>N&amp;E</td>
<td>85 to 98%</td>
<td>90 to 100%</td>
</tr>
<tr>
<td>Overfrequency</td>
<td>N&amp;E</td>
<td>102 to 110%</td>
<td>2% below trip</td>
</tr>
<tr>
<td>Voltage unbalance</td>
<td>N&amp;E</td>
<td>5 to 20%</td>
<td>1% below drop-out</td>
</tr>
</tbody>
</table>

B. Repetitive accuracy of all settings shall be within 0.5% over an operating temperature range of -20 degrees C to 60 degrees C.

C. Voltage and frequency settings shall be field adjustable in 1% increments either locally with the display and keypad or remotely via serial communications port access.

D. The controller shall be capable (when activated by the keypad or through the serial port) of sensing the phase rotation of both the normal and emergency sources. The source shall be considered unacceptable if the phase rotation is not the preferred rotation selected (ABC or CBA).

E. Source status screens shall be provided for both normal and emergency to provide digital readout of voltage on all 3 phases, frequency, and phase rotation.

### 3.11 TIME DELAYS

A. An adjustable time delay of 0 to 6 seconds shall be provided to override momentary normal source outages and delay all transfer and engine starting signals. Capability shall be provided to extend this time delay to 60 minutes by providing an external 24 VDC power supply.

B. A time delay shall be provided on transfer to emergency, adjustable from 0 to 60 minutes, for controlled timing of transfer of loads to emergency.

C. Two time delay modes (which are independently adjustable) shall be provided on retransfer to normal. One time delay shall be for actual normal power failures and the other for the test mode function. The time delays shall be adjustable from 0 to 60 minutes. Time delay shall be automatically bypassed if the emergency source fails and the normal source is acceptable.

D. A time delay shall be provided on shut down of engine generator for cool down, adjustable from 0 to 60 minutes.

E. A time delay activated output signal shall also be provided to drive an external relay(s) for selective load disconnect control.

The controller shall have the ability to activate an adjustable 0 to 5 minute time delay in any of the following modes:
1. Prior to transfer only
2. Prior to and after transfer
3. Normal to emergency only
4. Emergency to normal only
5. Normal to emergency and emergency to normal
6. All transfer conditions or only when both sources are available

F. The controller shall also include the following built-in time delays for optional Closed Transition and Delayed Transition operation:
   1. 1 to 5 minute time delay on failure to synchronize normal and emergency sources prior to closed transition transfer.
   2. 0.1 to 9.99 second time delay on an extended parallel condition of both power sources during closed transition operation.
   3. 0 to 5 minute time delay for the load disconnect position for delayed transition operation.

G. All time delays shall be adjustable in 1 second increments, except the extended parallel time, which shall be adjustable in .01 second increments.

H. All time delays shall be adjustable by using the LCD display and keypad or with a remote device connected to the serial communications port.

3.12 WITHSTAND AND CLOSING RATINGS

A. The ATS shall be rated to close on and withstand the available RMS symmetrical short circuit current at the ATS terminals with the type of overcurrent protection shown on the plans.

B. The ATS shall be UL Listed in accordance with UL 1008 and be labeled in accordance with that standard’s 1.5 and 3-cycle long-time ratings. ATSs which are not tested and labeled with 1.5 and 3-cycle (any breaker) ratings and have series or specific breaker ratings only are not acceptable.

3.13 SERVICE REPRESENTATION

A. The ATS manufacturer shall maintain a national service organization of company-employed personnel located throughout the contiguous United States. The service center’s personnel must be factory trained and must be on call 24 hours a day, 365 days a year.

B. The manufacturer shall maintain records of each switch, by serial number, for a minimum of 20 years.

C. The automatic transfer switch(es) shall be supplied by the generator set distributor in order to establish and maintain a single source of system responsibility and coordination.
PART 4 - MISCELLANEOUS

4.1 FACTORY TESTING

A. Before shipment of the equipment, the engine-generator set shall be tested under rated 0.8 PF load for performance and proper functioning of control and interfacing circuits. A factory test report shall be made available upon request. Tests shall include:

1. Verifying all safety shutdowns are functioning properly.
2. Both no-load and full-load steady state voltage checks shall be tested and measured line to line and speed (frequency) checks. Line-to-line current at rated voltage shall also be tested and measured.

4.2 OWNER’S MANUALS

A. Three (3) sets of Owner’s manuals specific to the product supplied must accompany delivery of the equipment. General operating instruction, preventive maintenance, wiring diagrams, schematics and parts exploded views specific to this model must be included.

4.3 INSTALLATION

A. The Contractor shall install the complete electrical generating system including all fuel connections in accordance with the manufacturer’s recommendations as reviewed by the Engineer.

B. The Contractor shall furnish to the Owner a manufacturer tank chart with inches-to-gallon conversions. The Contractor shall mount a laminated copy of the chart inside the generator module for use by the delivery operator.

4.4 SERVICE

A. Supplier of the electric plant and associated items shall have permanent service and parts facilities in this trade area. These facilities shall comprise a permanent force of factory trained service personnel on 24-hour call, experienced in servicing this type of equipment, providing warranty and routine maintenance service to afford the Owner maximum protection. Delegation of this service responsibility for any of the equipment listed herein will not be considered fulfillment of these specifications. Service contracts shall also be available.

4.5 WARRANTY

A. The standby electric generating system components, complete engine-generator set and automatic transfer switch shall be warranted by the manufacturer against defective materials and factory workmanship for a period of five years. Such defective parts shall be repaired or replaced at the manufacturer’s option. In addition, all labor for the replacement of these parts for the engine-generator set and transfer switch will be covered for the first two years. The warranty period shall commence when the standby power system is first placed into service. Multiple warranties for individual components (engine, alternator, controls, etc.) will not be acceptable and must be covered by the engine manufacturer. Satisfactory warranty documents must be provided. Also, in the judgment of the specifying authority, the manufacturer supplying the warranty for the complete system must have the necessary financial strength and technical expertise with all components supplied to provide adequate parts, service and warranty support.
4.6 CHECKOUT & STARTUP

A. The supplier of the electric generating plant and associated items covered herein shall provide factory trained technicians to check out the completed installation and to perform an initial startup inspection to include:

1. Ensuring the engine starts (both hot and cold) within the specified time.
2. Verification of engine parameters within specification.
3. Set no load frequency and voltage.
4. Test all automatic shutdowns of the engine-generator.
5. Perform a full load test of the electric plant, ensuring full load frequency and voltage are within specification by using building load supplemented with load banks. Test shall be per NFPA 110-2002 Paragraph 5-13.2.5.

4.7 SUBMITTALS

A. Provide complete sets of Engineering Submittals for approval prior to production release, showing all components, in addition to the engine, generator and automatic transfer switch. Submittals shall include complete system interconnection wiring diagrams and manufacturer’s warranty form indicating compliance with these specifications.

4.8 SUBSTITUTIONS

A. The emergency power system has been designed to the specified manufacturer’s electrical and physical characteristics, including the equipment sizing, spacing, mounts, electrical wiring, ventilation equipment, fuel and exhaust components. Should any substitutions be made, the Contractor shall bear responsibility for the installation, coordination and operation of the system as well as any engineering and redesign costs which may result from such substitutions. Alternate equipment suppliers shall furnish equipment submittals 14 days prior to bid date for approval to bid. As part of the submittals, the substitute manufacturer shall supply as a minimum engine, alternator, control panel and automatic transfer switch wiring diagrams and schematics. A separate list of all printed circuit boards with part numbers and current pricing must also be included.

END OF SECTION
PART 1 - GENERAL

1.1 DESCRIPTION

A. These specifications describe the electrical and mechanical requirements for a hybrid high-energy power conditioning filter incorporating surge protective devices and high-frequency electrical line noise filtering. The specified unit shall provide effective high-energy surge protection, surge current diversion, high-frequency attenuation, and line control in ANSI/IEEE C62.41.1-2002 environments connected on the load side of the facility’s meter or main overcurrent device. The unit shall be connected in parallel with the facility’s wiring system.

1.2 QUALITY ASSURANCE

A. The requirements of the following standards shall become a part of this Specification by reference:

2. Canadian Standards Association (CSA)
3. Federal Information Processing Standards Publication 94 (FIPS PUB 94)
4. National Electrical Manufacturers Association (NEMA)
5. National Fire Protection Association (NFPA 70 (NEC), 75 and 78)
6. Underwriters Laboratories Inc. (UL 1449 3rd Edition and 1283)

The unit shall be UL and cUL 1449 3rd Edition Listed as a Surge Protective Device.

B. Acceptable Manufacturers

1. Current Technology
2. Thor Systems

C. Testing: The unit shall be thoroughly factory-tested before shipment. Testing of each unit shall include but not be limited to quality assurance checks, MCOV and clamping voltage verification tests.

D. Warranty: The manufacturer shall provide a minimum 5-year warranty from date of shipment against failure when installed in compliance with applicable national/local electrical codes and the manufacturer’s installation, operation and maintenance instructions.

E. Submittal Documentation: Documentation of unit’s UL 1449 3rd Edition Voltage Protective Rating (VPR) shall be included as required product data submittal information. Manufacturer shall make available upon request certified documentation of applicable Location Category Testing in full compliance with ANSI/IEEE C62.41.1-2002, C62.41.2-2002, and C62.45-2002 Guidelines. The manufacturer shall furnish an equipment manual with installation, operation, and maintenance instructions for the specified unit. Electrical and mechanical drawings shall be provided by the manufacturer which show unit dimensions, weights, mounting provisions, connection details and layout diagram of the unit.
PART 2 - PRODUCTS

2.1 GENERAL MATERIALS REQUIREMENT

A. The unit shall provide all modes of protection: line to neutral, line to ground, and neutral to ground.

B. High Frequency Tracking Filter: The unit shall include a UL1283 high-frequency extended range tracking filter. The filter shall reduce fast rise-time, high-frequency, error producing transients and electrical line noise to harmless levels, thus eliminating disturbances which may lead to system upset.

C. Unit Status Indicators: The unit shall include solid-state, long-life, externally mounted LED visual status indicators that indicate the status of MOV fusing.

D. Transient Counter: Front cover mounted transient counter (LCD or LED) shall totalize surges for all modes.

E. Nominal discharge current rating shall be \(I_n\) 20 kA.

F. Minimum SPD fault current ratings shall be 100Kaic.

PART 3 - APPLICATIONS

3.1 SERVICE ENTRANCE/MAIN DISTRIBUTION APPLICATIONS

A. The following table will indicate appropriate model numbers based on the electrical system ampacity. Surge current ratings are based on the Site Shield Risk Assessment Spreadsheet (TSI 067 3gSSH/r3).

<table>
<thead>
<tr>
<th>Electrical System Ampacity @ SPD Install Point</th>
<th>Surge Protection (kA)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Per Mode</td>
<td>Per Phase</td>
</tr>
<tr>
<td>---------------------------------------------</td>
<td>-----------------------</td>
</tr>
<tr>
<td>4000 – 6000A</td>
<td>300</td>
</tr>
<tr>
<td>2000 – 3000A</td>
<td>250</td>
</tr>
<tr>
<td>1200 – 1600A</td>
<td>200</td>
</tr>
<tr>
<td>600 – 1000A</td>
<td>150</td>
</tr>
<tr>
<td>125 – 400A</td>
<td>100</td>
</tr>
</tbody>
</table>

B. SPDs connected to service equipment shall be listed as a type 1 SPD per UL1449 3rd Edition and shall have integral disconnect switch, and shall be connected to bus on the load side of the main switch.

3.2 PANELBOARDS AND BRANCH PANEL APPLICATIONS

A. As indicated on the Drawings, provide a panelboard with externally mounted SPD with high-frequency filtering per requirements listed in this specification. Provide number of breakers, voltage/phases as indicated on the Drawings. SPD shall physically connect to the top or bottom of panelboard allowing for SPD to be repaired or replaced without opening the dead front of the panelboard.
B. SPDs connected to Panelboards or Branch Panels shall be listed as a type 1 or type 2 SPD per UL1449 3rd Edition and shall be circuit breaker connected.

C. The following table indicates appropriate model numbers based on the electrical system ampacity. Surge current ratings are based on Site Shield Risk Assessment Spreadsheet (attached #TSI 067 3gSSH/r3). SPDs connected to Panelboards and Branch Panels shall be listed as a type 1 or type 2 SPD per UL 1449 3rd Edition and shall be 30 Amp circuit breaker connected.

<table>
<thead>
<tr>
<th>Manufacturer/Model Nos.</th>
<th>Electrical System Ampacity @ SPD Install Point</th>
<th>Surge Protection (kA)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Ampacity</td>
<td>Per Mode</td>
</tr>
<tr>
<td>Current Tech</td>
<td>Thor Systems</td>
<td>600A</td>
</tr>
<tr>
<td>EGPE2 150</td>
<td>TSnc 150</td>
<td>125 – 400A</td>
</tr>
<tr>
<td>EGPE2 100</td>
<td>TSnc 100</td>
<td>100A</td>
</tr>
</tbody>
</table>

PART 4 - EXECUTION

4.1 INSTALLATION

A. Install wiring connection to distribution system as indicated on the Drawings. Wiring length should be kept to an absolute minimum (3’ or less) and be as straight as possible.

B. Wire sizes to Service Entrance/Main Distribution SPD should be 4#6, 1#6 G - 1” conduit.

C. Wire sizes to Panelboard and Branch Panel SPD should be as indicated 4#10, 1#10G – ¾” conduit.

END OF SECTION
PART 1 - GENERAL

1.1 DESCRIPTION

A. The work required under this section of the Specifications consists of furnishing, installation and connections of the building grounding system. Exterior branch circuit wiring and feeder conductors extended beyond the building are included. The building electrical system shall be 3-phase, 4-wire grounded wye system supplemented with equipment grounding system. Equipment grounding system shall be established with equipment grounding conductors; the use of metallic raceways for equipment grounding is not acceptable.

1.2 REGULATORY REQUIREMENTS

A. Install a complete grounding system in accordance with the National Electrical Code.

PART 2 - PRODUCTS

2.1 GENERAL REQUIREMENTS

A. Provide all materials under this section of the specifications.

B. All materials shall be new, UL Listed, and bear a UL Label.

C. Refer to Section 16120 - Conductors for conductor specification.

2.2 GROUNDING CONDUCTORS

A. Grounding electrode conductor shall be bare or green insulated copper conductor sized as indicated on the Drawings.

B. Equipment grounding conductors shall be green insulated conductors sized as indicated on the Drawings. Where size is not indicated on the Drawings, conductor size shall be determined from the National Electrical Code table on sizes of equipment grounding conductors.

C. Bonding jumpers shall be flexible copper bonding jumpers sized in accordance with the National Electrical Code tables for grounding electrode conductors.

2.3 PANELBOARDS, TRANSFORMERS, AND DISCONNECT SWITCHES

A. Provide each low voltage distribution and branch circuit panelboard with a copper equipment grounding bar brazed or riveted to the associated enclosures or cabinet and an insulated neutral bar.

B. Provide a conductor termination grounding lug bonded to the enclosure of each equipment item.

2.4 DEVICES

A. Each receptacle and switch device shall be furnished with a grounding screw connected to the metallic device frame.
2.5 GROUND RODS
A. Ground rods shall be 3/4" x 10'-0" copper clad steel.

2.6 GROUNDING LUGS FOR LOW VOLTAGE SYSTEMS
A. Grounding Lugs and Hardware
   1. Grounding lugs shall be 2-hole and installed with a crimper that when properly executed the die of the crimper impresses the die # on the lug base. All lugs shall be sleeved with clear heat-shrink to allow for inspection of the crimp. Silicon bronze or stainless steel bolts and washers shall be used to install lugs to equipment. Exothermic welding is also allowed.

2.7 GROUNDING BUSBARS FOR LOW VOLTAGE SYSTEMS
A. Grounding Busbar
   1. The grounding busbar shall be made of 1/4" thick solid copper.
   2. The grounding busbar shall be installed with minimum clearance, 1" offsets and 1-1/2" insulators.
   3. The grounding busbar shall accommodate 2-hole compression lugs.
   4. The grounding busbar shall meet or exceed J-STD-607-A requirements.

PART 3 - EXECUTION

3.1 INSTALLATION
A. Ground all non-current carrying parts of the electrical system including raceways, equipment frames and enclosures, outlet boxes, junction boxes, and other conductive material in close proximity with electrical circuits.

B. Service entrance and separately derived electrical systems, grounding electrode system
   1. The grounded conductor(s) of the electrical service serving the premises wiring system shall be connected to the neutral bus bar in the service equipment which shall be grounded to the cold water system, the ground rod system, and other grounding electrodes specified herein or indicated on the Drawings. Grounding electrode conductors shall be installed rigid, nonmetallic conduit to point of ground connection, unless subject to physical damage in which case it shall be installed in galvanized rigid steel.
   2. Make connection to main water line entering the building. Make connections ahead of any valve or fittings whose removal may interrupt ground continuity.
   3. Bond together the following systems to form the grounding electrode system. All system connections shall be made to the electrodes as close as possible to the service entrance equipment and each connected at the service entrance equipment neutral bus. Do not connect electrode systems together except at neutral bus.
      a. Cold water piping system
      b. Ground rod system
c. Rebar in concrete footing  
d. Structural steel metal building frame

4. Grounding electrode connections to structural steel, reinforcing bars, ground rods, or where indicated on the Drawings shall be with chemical exothermic weld connection devices recommended for the particular connection type. Connections to piping shall be with UL Listed mechanical ground clamps.

5. Where there is more than one service to a building or interconnected buildings, services shall be connected by means of a grounding electrode conductor.

6. Bonding shall be in accordance with the National Electrical Code.

7. Install ground rods where indicated on the Drawings with the top of the ground rods 12 inches below finished grade.

8. Ground the neutral and frame of the emergency generator to building steel and the main electrical service ground rod system. In reinforced concrete structures building steel shall be considered to be reinforcing steel or vertical columns. Make connection to building steel with chemical weld type connector, in a location in unfinished space where the connection will not be subject to physical abuse.

C. Equipment Grounding Conductor

1. Grounding conductors for branch circuits are not shown on the Drawings; however, grounding conductors shall be provided in all branch circuit raceways and cables.

2. Grounding conductors for feeders are typically indicated on the Drawings and the raceway is sized to accommodate grounding conductor shown. Where grounding conductor size is not indicated on the Drawings, conductor shall be in accordance with the equipment grounding conductor table of the National Electrical Code.

D. Other Grounding Requirements

1. Each telephone backboard shall be provided with a No. 6 grounding conductor. When backboard is located in vicinity of electrical service equipment, the “point of grounding” of this conductor shall be the main cold water service with connections made ahead of any valves or joints. Remote backboards shall use building steel as “point of ground.” Terminate conductor by stapling to backboard.

2. At each building expansion joint flexible copper bonding jumpers shall be attached to building structure by chemical weld process. Install bonding jumpers in concealed locations that will not subject connections or jumpers to physical abuse. Install 100’ on centers across expansion joints.

3.2 TESTING

A. Upon completion of the ground rod installation, the Contractor shall test the installation in accordance with the “Electrical Testing” section of Section 16000 - Electrical General. Grounding resistance reading shall be taken before connection is made to the building cold water piping system. Ground resistance readings shall not be taken within 48 hours of rainfall.

3.3 GROUNDING FOR LOW VOLTAGE SYSTEMS

A. The grounding and bonding system that supports low voltage systems shall be designed in accordance with the recommendations contained in the J-STD-607-A Telecommunications Bonding and Ground Standard.
B. All telecommunications rooms shall be equipped with a telecommunications ground busbar (TGB). Each TGB shall be connected to the building’s electrical ground at the electrical room closest to its proximity.

C. All wires used for communications grounding purposes shall be identified with green insulation. Non-insulated wires shall be identified at each termination point with a wrap or green tape. All cables and busbars shall be identified and labeled in accordance with the ANSI/TIA/EIA-606-A.

END OF SECTION
PART 1 - GENERAL

1.1 DESCRIPTION
A. This section specifies the lighting system requirements.
B. All fixtures shall be current source, provided with lamps ready to use.

1.2 RELATED WORK SPECIFIED ELSEWHERE
A. Refer to another division for the ceiling systems.
B. Lighting system shall be coordinated with the ceilings.

1.3 SUBSTITUTIONS/VALUE ENGINEERING/PRICING
A. Substitution/value engineering requests shall be accompanied by complete manufacturers data with model numbers, cut sheets with options indicated, and a full photometric report. For exterior lighting, a computer generated point by point calculation shall be provided.
B. All substitution requests shall be submitted in completion to Engineer at least 10 days prior to bid date.
C. Pricing for lighting fixtures shall be separate from pricing for lighting controls (occupancy sensors, relay controls, dimming).

PART 2 - PRODUCTS

2.1 BALLASTS
A. All fluorescent lamp ballasts shall be low-loss, high power factor Class “P,” with “A” sound rating and shall bear UL and CBM certifications. Ballast case temperature shall not exceed 90 degrees C.
B. All fluorescent fixtures shall be equipped with program-start ballasts. Multi-lamp ballasts shall be parallel-wired.
C. Linear and compact fluorescent lamp ballasts shall be electronic by Advance, General Electric, Osram Sylvania, or Universal.
D. All HID lighting fixtures shall have a high power factor, regulated output ballast provided by the fixture manufacturer, pre-wired with a glass tube fuse holder and fuse on each primary hot lead.

2.2 LAMPS
A. Fluorescent lamps shall be energy saving type, 3,500 degrees K, CRI 75, of size and wattage as scheduled on the Drawings, unless noted otherwise on Light Fixture Schedule. They shall be General Electric or equal as manufactured by Sylvania or Philips unless indicated otherwise on Drawings. Lamps shall have a rated life of 20,000 hours minimum at three (3) hours per start.
B. Incandescent lamps shall be of type, size and voltage as scheduled on the Drawings. Lamps shall be of the extended service type with a rated life of 2,500 hours. Reflector lamps (R and PAR) shall have a rated life of 2,000 hours for the standard type and 4,000 hours for the “Quartz” or “Krypton” types. Quartz lamps shall be clear with a rated life of 2,000 hours.

2.3 LIGHTING FIXTURES

A. Letter designations beside outlet symbols on Drawings correspond to letter designations in Lighting Fixture Schedule.

B. Recessed incandescent fixtures, where used in an insulated ceiling, shall be equipped with thermal protection and shall bear the UL Label indicating the suitability for such use.

C. Lens material for recessed fluorescent fixtures shall be 100% virgin acrylic, 0.125” thick in a square prism pattern similar to KSH-K-12 or as scheduled in Lighting Fixture Schedule.

D. Site lighting poles shall meet or exceed the local wind loading requirements of authority having jurisdiction.

E. Concrete pole bases shall be required for site lighting poles.

F. Recessed lighting fixtures installed in the building thermal envelope (e.g. attic) shall be IC rated and labeled with enclosures that are sealed and gasketed to limit air leakage between conditioned and non-conditioned spaces.

G. All linear fluorescent lighting fixtures (with double-ended lamps) shall have a factory-installed, concealed disconnecting means for each ballast.

PART 3 - EXECUTION

3.1 LIGHTING FIXTURES

A. Provide lighting fixtures at all locations indicated by distinctive symbols or notes on the Drawings.

B. Lighting fixtures shall be secured to ceiling grid with clips or screws and two #12 steel wires mounted to opposite corners of light fixture secured to structure.

C. Locations of lighting fixtures on the electrical drawings are approximate. Refer to Architectural reflected ceiling plan for actual locations of fixtures and mounting heights.

D. Lighting fixtures installed in plaster and stucco ceiling shall have plaster frame and shall be of the flanged type.

E. Fixtures recessed in concealed-spline tile and in gypsum board ceilings shall be flanged.

F. Surface or recessed fixtures in or on plastered ceilings shall be supported from pieces of support channel spanning across the main supporting channels and shall not depend on the metal lath for support.
G. Each recessed lighting fixture shall have a trim to match the type of ceiling (exposed grid, metal panel, etc.) in which it is being installed, except where noted otherwise on the plans.

H. Each lighting fixture recessed in a concrete wall shall have a junction box or wiring compartment provided inside the fixture housing. Provide conduit access into the fixture concealed.

END OF SECTION
PART 1 - GENERAL

1.1 WORK INCLUDED

A. The Contractor's work shall include all labor, materials, tools, appliances, control hardware, sensor, wire, junction boxes and equipment necessary for and incidental to the delivery, installation and furnishing of a completely operational occupancy sensor lighting control system, as described herein.

B. The Contractor/supplier shall examine all general specification provisions and drawings for related electrical work required as work under Division 16.

C. The Contractor shall coordinate all work described in this section with all other applicable plans and specifications, including but not limited to wiring, conduit, fixtures, HVAC systems and building management systems.

1.2 EQUIPMENT QUALIFICATION

A. Products supplied shall be from a single manufacturer that has been continuously involved in the manufacturing of occupancy sensors for a minimum of five (5) years. Mixing of manufacturers shall not be allowed.

B. All components shall be UL Listed, offer a 5-year warranty and meet all state and local applicable code requirements.

C. Products shall be manufactured by an ISO 9002 certified manufacturing facility and shall have a defect rate of less than 1/3 of 1%.

D. Wall switch products must be capable of withstanding the effects of inrush current. Submittals shall clearly indicate the method used.

1.3 SYSTEM DESCRIPTION

A. The objective of this section is to ensure the proper installation of the occupancy sensor based lighting control system so that lighting is turned off automatically after reasonable time delay when a room or area is vacated by the last person to occupy said room or area.

B. The occupancy sensor based lighting control shall accommodate all conditions of space utilization and all irregular work hours and habits.

C. The Contractor shall warrant all equipment furnished in accordance to this specification to be undamaged, free of defects in materials and workmanship, and in conformance with the specifications. The supplier's obligation shall include repair or replacement, and testing without charge to the Owner, all or any parts of equipment which are found to be damaged, defective or non-conforming and returned to the supplier. The warranty shall commence upon the Owner's acceptance of the project. Warranty on labor shall be for a minimum period of one (1) year.
1.4 SUBMITTALS
A. Manufacturer shall substantiate conformance to this specification by supplying the necessary documents, performance data and wiring diagrams. Any deviations to this specification must be clearly stated by letter and submitted.
B. Submit a lighting plan clearly marked by manufacturer showing proper product, location and orientation of each sensor.
C. Submit any interconnection diagrams per major subsystem showing proper wiring.
D. Submit standard catalog literature which includes performance specifications indicating compliance to the specification.
E. Catalog sheets must clearly state any load restrictions when used with electronic ballasts.

1.5 SYSTEM OPERATION
A. It shall be the Contractor’s responsibility to make all proper adjustments to assure Owner’s satisfaction with the occupancy system.

1.6 ACCEPTABLE MANUFACTURERS
A. The Watt Stopper, or Pre-Approved Equal: For pre-approval, provide all the information listed under section 1.4 A and 1.4 D a minimum of ten (10) working days prior to initial bid date.
B. The listing of any manufacturer as “acceptable” does not imply automatic approval. It is the sole responsibility of the electrical contractor to ensure that any price quotations received and submittals made are for sensors which meet or exceed the specifications included herein.

PART 2 - PRODUCTS
2.1 GENERAL
A. All products shall be Watt Stopper product numbers.
4. HID Control: DM-100.
5. Outdoor Sensors: EW-100, EW-200, EN-100, EN-200.
B. Wall switch sensors shall be capable of detection of occupancy at desktop level up to 300 square feet, and gross motion up to 1000 square feet.
C. Wall switch sensors shall accommodate loads from 0 to 800 watts at 120 volts; 0 to 1,200 watts at 277 volts and shall have 180 degrees coverage capability.

D. Wall switch products shall utilize Zero Crossing Circuitry, which increases relay life, protects from the effects of inrush current, and increases sensor’s longevity.

E. Wall switch sensors shall have no leakage current to load, in manual or in Auto/Off mode for safety purposes and shall have voltage drop protection.

F. Where specified, wall switch sensors shall provide a field selectable option to convert sensor operation from automatic-ON to manual-ON.

G. Where specified, vandal resistant wall switch sensors shall utilize a hard lens with a minimum 1.0 mm thickness. Products utilizing a soft lens will not be considered.

H. Passive infrared sensors shall utilize Pulse Count Processing and Digital Signature Analysis to respond only to those signals caused by human motion.

I. Passive infrared sensors shall utilize mixed signal ASIC which provides high immunity to false triggering from RFI (hand-held radios) and EMI (electrical noise on the line), superior performance, and greater reliability.

J. Passive infrared sensors shall have a multiple segmented Lodif Fresnel lens, in a multiple-tier configuration, with grooves-in to eliminate dust and residue build-up.

K. Where specified, passive infrared and dual technology sensors shall offer daylighting footcandle adjustment control and be able to accommodate dual level lighting.

L. Dual technology sensors shall be corner mounted to avoid detection outside the controlled area when doors are left open.

M. Dual technology sensors shall consist of passive infrared and ultrasonic technologies for occupancy detection. Products that react to noise or ambient sound shall not be considered.

N. Ultrasonic sensors shall utilize Advanced Signal Processing to adjust the detection threshold dynamically to compensate for constantly changing levels of activity and air flow throughout controlled space.

O. Ultrasonic operating frequency shall be crystal controlled at 25 kHz within ±0.005% tolerance, 32 kHz within ±0.002% tolerance, or 40 kHz ±0.002% tolerance to assure reliable performance and eliminate sensor crosstalk. Sensors using multiple frequencies are not acceptable.

P. All sensors shall be capable of operating normally with electronic ballasts, PL lamp systems and rated motor loads.

Q. Coverage of sensors shall remain constant after sensitivity control has been set. No automatic reduction shall occur in coverage due to the cycling of air conditioner or heating fans.
R. All sensors shall have readily accessible, user adjustable settings for time delay and sensitivity. Setting shall be located on the sensor (not the control unit) and shall be recessed to limit tampering.

S. In the event of failure, a bypass manual override shall be provided on each sensor. When bypass is utilized, lighting shall remain on constantly or control shall divert to a wall switch until sensor is replaced. This control shall be recessed to prevent tampering.

T. All sensors shall provide an LED as a visual means of indication at all times to verify that motion is being detected during both testing and normal operation.

U. Where specified, sensor shall have an internal additional isolated relay with Normally Open, Normally Closed and Common outputs for use with HVAC control, Data Logging and other control options. Sensors utilizing separate components or specially modified units to achieve this function are not acceptable.

V. All sensors shall have UL rated, 94V-0 plastic enclosures.

W. Outdoor motion sensors shall have UL 773A ratings. EWF outdoor sensors shall additionally have UL 1571 ratings.

X. EW-100 outdoor sensors shall cover up to 35 feet, with a field of view of 180 degrees. EW-200 outdoor sensors shall cover up to 52.5 feet, with a field of view of 270 degrees. EN-100 outdoor sensors shall cover up to 35 feet, with a field of view of 90 degrees. EN-200 outdoor sensors shall cover up to 100 feet, with a long range lens view.

Y. EWF outdoor sensors shall include polycarbonate lamp holders that accept PAR 20 or 38 lamps up to 150W per lamp.

Z. Outdoor sensors shall have an operating temperature range of -40 degrees F to +130 degrees F.

AA. To ensure complete protection from weather elements and exposure, outdoor sensors shall be manufactured with precision double-shot tooling and contain internal silicon gaskets.

BB. HID controller shall be compatible with all types of High Intensity Discharge (HID) lamps, including Metal Halide, Metal Halide Pulse Start, and High Pressure Sodium.

CC. HID controller shall operate with HID lamps utilizing Constant Wattage Autotransformer (CWA) type ballasts.

DD. To avoid lamp damage during the HID power up period, the HID controller shall maintain a full light level during lamp warm up for 15 minutes.

EE. To maximize lighting control scenarios, the HID controller shall be compatible with any 24 VDC controlling device, such as occupancy sensors, time switches, control panels, or photocells.

FF. The HID controller shall be capable of linking to other HID control modules to enable effective multi-zone control. More than 100 individual devices shall be capable of being connected.
2.2 CIRCUIT CONTROL HARDWARE – CU

A. Control Units: For ease of mounting, installation and future service, control unit(s) shall be able to externally mount through a 1/2" knock-out on a standard electrical enclosure and be an integrated, self-contained unit consisting internally of an isolated load switching control relay and a transformer to provide low-voltage power. Control unit shall provide power to minimum of two (2) sensors.

B. Relay Contacts shall have rating of:
   - 13A - 120 VAC Tungsten
   - 20A - 120 VAC Ballast
   - 20A - 277 VAC Ballast

C. Control wiring between sensors and control units shall be Class II, 18-24 AWG, stranded UL Classified, PVC insulated or TEFLON jacketed cable suitable for use in plenums, where applicable.

D. Minimum acceptable wire gauge from the circuit control hardware relays shall be #14 AWG.

PART 3 - EXECUTION

3.1 INSTALLATION

A. It shall be the Contractor's responsibility to locate and aim sensory in the correct location required for complete and proper volumetric coverage within the range of coverage(s) of controlled areas per the manufacturer's recommendations. Rooms shall have 90 to 100% coverage to completely cover the controlled area to accommodate all occupancy habits of single or multiple occupants at any location within the room(s). The locations and quantities of sensors shown on the drawings are diagrammatic and indicate only the rooms which are to be provided with sensors. The Contractor shall provide additional sensors if required to properly and completely cover the respective room.

B. It is the Contractor's responsibility to arrange a pre-installation meeting with the manufacturer's factory authorized representative, at the Owner's facility, to verify placement of sensors and installation criteria.

C. Proper judgment must be exercised in executing the installation so as to ensure the best possible installation in the available space and to overcome local difficulties due to space limitations or interference of structural components. The Contractor shall also provide, at the Owner's facility, the training necessary to familiarize the Owner's personnel with the operation, use, adjustment, and problem solving diagnosis of the occupancy sensing devices and systems.

END OF SECTION
PART 1 - GENERAL

1.1 DESCRIPTION
A. This section covers the complete installation of a new automatic fire alarm system, as well as necessary materials, labor, calibration, testing and training.

B. The complete installation shall be in compliance with NFPA 70, 72, 101 (Life Safety Code) and NEC Article 760. The installation shall also comply with state and local ordinances, as well as the Americans with Disabilities Act (Public Law 101-336).

C. All equipment supplied shall be listed for the purpose and area in which it is used and installed in accordance with any instructions included in its listing.

D. All equipment must be new and bear the UL (Underwriters Laboratories Inc.) Label.

1.2 SHOP DRAWINGS
A. Fire alarm shop drawings shall contain the following:
   1. Specification sheet/sheets of technical data on each hardware component
   2. Specification sheet(s) on wiring to be utilized
   3. One-line schematic riser diagram made specifically for this job
   4. Calculation for sizing batteries and power supplies
   5. Sequence of operation for the entire system
   6. Copy of vendor's NICET fire alarm certificate (level III or higher)
   7. Verification of central supervising station (UL Certified)
   8. Equipment and service warranty
   9. Scaled floor plans showing fire alarm device locations and wire routing

1.3 ACCEPTABLE MANUFACTURERS
A. Products of the following manufacturers which comply with these specifications are acceptable:
   1. Notifier
   2. Siemens
   3. E.S.T.
   4. Simplex
   5. Gamewell-FCI

1.4 STORAGE AND HANDLING
A. Smoke detectors shall be covered with plastic wrapping if installed prior to the completion of painting, sanding and other work producing dust, etc.

B. The fire alarm control panel(s) shall not be installed until its designated room has been completely painted and cleaned.
PART 2 - PRODUCTS

2.1 CONTROL PANEL/SYSTEM DESCRIPTION

A. The fire alarm system shall be an electrically supervised, power limited, low voltage (24 VDC), non-coded, multiplexed, fully analog, addressable system. The fire alarm control panel shall be of modular design for ease of future system addition or modification (up to 20% addition capacity).

B. The control panel shall provide system status via an 80 character liquid crystal display and shall also have the following features:

1. Power "ON" Light Emitting Diode (LED)
2. System Reset Switch
3. System Alarm LED
4. System Trouble LED
5. Alarm Silence Display
6. Trouble Silence Display
7. Control panel shall be lockable.
8. Normally open and normally closed sets of contacts for control of remote equipment/devices.

C. Batteries shall be mounted in space provided in the fire alarm control panel. Control panel shall include automatic charging circuit to maintain battery/batteries in charged condition. Batteries may be lead acid or nicad; charging circuit shall match battery type.

D. The battery/batteries shall have sufficient ampere-hour capacity to operate the system under normal supervisory conditions with A.C. power disconnected for 4 hours, and at the end of that period to operate all alarm notification appliances for 5 minutes. For calculation purposes, all audible devices shall be tapped at a minimum of one (1) watt.

E. The system shall operate from one (1) 20 -ampere, single-phase, 3-wire 120 V.A.C. circuit. The circuit breaker shall be labeled "Fire Alarm Circuit Control."

F. The fire alarm system shall respond to a fire emergency through the operation of the following systems:

1. Smoke damper control and automatic shutdown of HVAC air systems shall occur upon activation of respective duct smoke detector.
2. Automatic audible/visual notification (via horns/strobes) shall be provided upon activation of a flow switch, manual station, or area smoke detector.
3. Signal output to the UL Listed central station (for fire system reporting) via a D.A.C.T. communication device (or similar UL Listed “fire” device) in FACP(s). Provide and install 3/4" conduit from the panel to the main telephone backboard.
4. Smoke door release (where applicable) shall occur generally throughout the entire facility.
5. Tamper switch operation shall cause a supervisory signal to indicate audibly and visually at the control panel.
6. The following conditions of emergency generator(s) shall be monitored by the fire alarm system:

   a. Generator running
b. Generator fault
c. Generator switch in non-automatic position

7. Fusible link operation for all fire shutters.

G. Supervision

1. Initiating Device Circuits (IDC) shall be Class B, Style B.
2. Signaling Line Circuits (SLC) shall be Class B, Style 4.
3. Notification Appliance Circuits (NAC) shall be Class B, Style Y.
4. Power failures, opens, or grounds shall be audibly and visually indicated at the control panel and the remote annunciator (where applicable). A green “power on” LED shall be displayed continuously while incoming power is present.
5. Power wiring to sprinkler pipe heat tracing shall be supervised by fire alarm system.

H. Provide remote annunciator panel with 80 character liquid crystal display, audible signal and alarm/trouble lights.

I. Transient Voltage Surge Suppression

1. Surge protection shall be provided for any copper NAC, IDC and SLC circuits which are installed underground outside of a building.
2. Modules shall be mounted in NEMA 12 steel enclosure adjacent to FACP.
3. Approved manufacturer/model: DITEK DTK-TSS1

2.2 FIELD DEVICES

A. Manual Stations: Semi-flush, addressable, double action type. Station shall be constructed of high impact red polycarbonate.

B. Area Smoke Detectors: Smoke detectors shall be of the analog, addressable, photoelectric type. A pulsed diode pilot lamp, visible from the floor, shall be provided to indicate alarm condition or component failure. Diode pilot lamp may be pulsed diode type for normal and steady for alarm trouble indication. Detectors shall be self-supervising for component failure as well as line failure. Detector failure or removal of detector shall initiate (zone) trouble signal. Detector shall be capable of monitoring 900 square feet of unobstructed area with spacing not to exceed 30 feet on center. Smoke detectors shall be ceiling mounted and shall be interconnected into alarm system to function in same manner as the manual station. Detectors shall report analog level of smoke/dirt to panel.

C. Duct Smoke Detectors: Detectors shall be of the analog, addressable, photoelectric type. The unit shall consist of a detector and an air sampling assembly housed in a casting designed for duct mounting. The sampling tubes shall extend completely across the duct. Detectors shall report analog level of smoke/dirt to panel. Where detector LEDs are concealed or not easily observable, detectors shall have remote LED alarm indicators in an observable location for alarm identification. Each LED shall be labeled to identify location of duct smoke detector.

D. Audible/Visual Devices: Audible/visual devices shall be horns with flashing visual appliances with the word “FIRE” written on the lens. The horns shall produce at least 15 dBA above ambient noise level. Audible and visual devices (including the combination device) shall utilize a 4" electrical backbox. Visual devices shall be multi-candela, field-
selectable, with a constant flash rate of one (1) flash per second. The device color shall be white.

E. Any audible device installed in a sleeping room shall have a low-frequency sounder approved for fire protective service, and shall be listed to UL 464. The device shall be powered from a notification appliance circuit output and shall operate on nominal 12 or 24 volts (includes fire alarm panels with built in sync). All notification appliances shall be backward compatible.

F. Addressable relays shall be provided as required to accomplish all mechanical systems and other related control functions.

G. Addressable input monitoring devices shall be provided as required to monitor existing water flow, tamper switch, and other devices.

H. Heat detectors shall be addressable, fixed temperature type rated at 135 degrees F, unless noted otherwise on drawings.

I. Monitoring of remote fire protection valves on site (if applicable) shall be accomplished via fire alarm system connection.

PART 3 - EXECUTION

3.1 GENERAL

A. The Contractor shall obtain approval from Owner as to the final and exact location of each control panel and remote annunciator prior to installation.

B. All wiring shall be suitably protected from damage. Wiring shall be routed within conduit where installed in the following areas:

1. underground
2. damp and wet locations
3. where exposed on interior walls
4. where concealed in a wall or inaccessible ceiling

C. All wiring installed exposed within a plenum shall be UL Listed accordingly. Plenum rated cable shall be tied to the building structure at approximately 6'-0" on center using cable ties.

D. Conduit sleeves with bushings shall be installed for fire alarm cabling that passes through walls and floor assemblies. Seal the opening around the conduit and the hole in the conduit with a UL Listed fire rated sealant as required.

E. Provide necessary programming to accomplish the indicated system operation and control functions.

F. All conduit, control wiring, power wiring, relays, and other equipment and devices required to form a complete and operational system shall be provided as part of this Contract.
G. All wiring requirements for shielding certain conductors from others or routing in separate raceways shall be as recommended by the manufacturer.

3.2 WARRANTY

A. Equipment, materials, workmanship and system performance incorporated into the work shall be guaranteed for a period of one (1) year from the time the Owner receives beneficial use of the fire alarm system and the acceptance tests herein specified have been satisfactorily completed. Any defects due to faulty materials, methods or installation or workmanship within this period shall be promptly repaired or replaced.

B. Vendor shall provide pricing for system inspections for a period of four (4) additional years after the initial 12-month warranty as a bid alternate to the Owner. Provide inspections per N.F.P.A. 72 and N.F.P.A. 101.

C. Spare Parts: Provide the following spare equipment items to the Owner upon project completion:

1. Addressable modules: 2
2. Smoke detectors: 2
3. Manual stations: 2
4. Duct mounted smoke detectors: 1
5. Audible/visual devices: 4

3.3 TESTING AND CERTIFICATION

A. Testing and certification of the life safety system per NFPA 72 2-2 shall be as required by the Fire Marshal and Engineer. The Contractor shall be responsible for identifying the required testing, coordinate scheduling, and conducting the test necessary to achieve occupancy certification, and assurance of complete system operation. The Contractor shall submit proof of complete system operation signed by the Fire Marshal to Engineer and Owner.

B. Contractor shall notify the Owner’s representative in writing that the Owner is responsible for hiring a monitoring agency for remote supervision of the fire alarm system.

END OF SECTION
PART 1 - GENERAL

1.1 GENERAL REQUIREMENTS

A. Applicable requirements of Section 16000 - Electrical General shall be considered a part of this section and shall have the same force as if printed herein full.

B. This document describes the products and execution requirements relating to backboards.

C. Product specifications, general design considerations, and installation guidelines are provided in this document. The successful vendor shall meet or exceed all requirements described in this document and/or on the Drawings.

1.2 WORK INCLUDED

A. The work included under this specification consists of furnishing all labor, equipment, materials, supplies and performing all operations necessary to complete the installation. The Contractor will provide and install all of the required material whether specifically addressed in the Specification or not.

B. The work shall include, but not be limited to the following:

1. Furnish and install all backboards.
2. Furnish and install all structured media enclosures.

PART 2 - PRODUCTS

2.1 APPROVED PRODUCTS

A. Approved Equipment Backboard Manufacturer(s)

   1. Hoover – ¾" Pyro-Guard
   2. Standard ¾" Plywood (treated with fire-retardant paint)

PART 3 - EXECUTION

3.1 BACKBOARDS

A. Backboards shall be 3/4" void free plywood. Size of backboard shall be 4’ x 8' unless noted differently on Drawings. Backboards shall be painted with two (2) coats of gray fire-retardant paint.

END OF SECTION