

# **SPECIFICATIONS**

**PROJECT:**

**16 MIDDLE STREET  
PORTLAND, MAINE**

**DEVELOPER:**

**16 MIDDLE STREET ASSOCIATES, LLC  
470 FORE ST., SUITE 400  
PORTLAND, ME 04104**

**ARCHITECT:**

**ARCHETYPE, P. A.  
48 UNION WHARF  
PORTLAND, MAINE 04101**

**June 3, 2016  
Construction Set**

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**END OF SECTION**

SECTION 01045

CUTTING AND PATCHING

1. GENERAL

1.1 REFERENCES

- A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division 1 Specification sections, apply to work of this Section.
- B. Divisions 2 through 16.

1.2 DESCRIPTION OF WORK

- A. Definition: "Cutting and patching" includes cutting into existing construction to provide for the installation or performance of other work and subsequent fitting and patching required to restore surfaces to their original condition. This section does not apply to new work that has been installed as part of the Work.
- B. Structural Work: Do not cut-and-patch structural work in a manner resulting in a reduction of load-carrying capacity or load/deflection ratio.
- C. Operational/Safety Limitations: Do not cut-and-patch operational elements and safety components in a manner resulting in decreased performance, shortened useful life, or increased maintenance.
- D. Visual/Quality Limitations: Do not cut-and-patch work exposed to view (exterior and interior) in a manner resulting in noticeable reduction of aesthetic qualities and similar qualities, as judged by the Architect/Engineer.
- E. Limitation on Approvals: The Architect/Engineer's approval to proceed with cutting and patching does not waive right to later require removal/replacement of work found to be cut-and-patched in an unsatisfactory manner, as judged by the Architect/Engineer.
- F. Materials marked to be removed and reused shall be repaired as necessary to maintain their existing condition. When repair is not sufficient, existing materials shall be disposed of and new materials installed to match existing materials.
- G. Refer to other sections of these specifications for specific cutting and patching requirements and limitations applicable to individual units of work.
- H. Unless otherwise specified, requirements of this Section apply to Mechanical and Electrical work. Refer to Divisions 15 and 16 for additional requirements and limitations on cutting and patching of mechanical and electrical work.

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### 1.3 QUALITY ASSURANCE

- A. Refer to Section 01631, Products and Substitutions, for general provisions covering product selection, substitutions, material storage and installation.
- B. Refer to Section 01400, Quality Control Services, for provisions for testing and inspections.
- C. Refer to specific Specification Section covering subject in question for quality assurance requirements.

### 1.4 SUBMITTALS

- A. Issue submittals in accordance with Section 01300, Submittals.
- B. Refer to specific Specification Section covering subject in question for submittal requirements.

## 2. PRODUCTS

### 2.1 GENERAL

- A. Use materials for cutting and patching that are identical to existing materials. If identical materials are not available, or cannot be used, use materials that match existing adjacent surfaces to the fullest extent possible with regard to visual effect. Use materials for cutting and patching that will result in equal-or-better performance characteristics.
- B. Fire-stopping:
  - 1. Seal openings in fire-rated walls and floors to make a tight fit with penetrating items, using appropriate non-combustible filler material. to provide a rating equivalent to wall/floor assemble.
  - 2. Acceptable filler materials include:
    - a. Concrete
    - b. Cementitious proprietary product: Zonolite Firestop ZF-1
    - c. Blanket-type mineral-fiber or ceramic-fiber insulation (glass-fiber insulation is not acceptable)
    - d. Fire-resistant sealant: Domtar Fire-Halt, Dow Corning Fire Stop, Hilti CS 240 Firestop, or Nelson CLK or CMP
    - e. Fire-resistant silicone foam: Dow Corning RTV Foam Penetration Seal System, Hilti CB 120 Adhesive Filling and Sealing Foam, Tremco Fyre-Sil
    - f. Flexible intumescent strip wrapped around pipe penetrations: Dow Corning Fire Stop Intumescent Wrap, Hilti CS 24720 Intumescent Wrap, Nelson RSW, Tremco TREMstop WS

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- g. Intumescent fibrous material enclosed in a polyethylene envelope: Nelson PLW, Tremco TREMstop PS
  - h. Pliable intumescent putty: Nelson FSP Flameseal, Tremco TREMstop WBM
  - i. Water-based intumescent fire-protective coating for electrical cables: Nelson CTG
3. Neatly patch and seal exposed-to-view openings, using sealants, tooled mortar joints, escutcheons, or flanged collars, as appropriate.

### 3. EXECUTION

#### 3.1 INSPECTION

- A. Before cutting, examine surfaces to be cut and patched and conditions under which the work is to be performed. If unsafe or otherwise unsatisfactory conditions are encountered, take corrective action before proceeding with the work.
- B. Cutting and patching of Structural Work shall be prohibited unless approved by the Engineer.
- C. Cutting of Operational and Safety appurtenances shall be prohibited unless approved by the Architect and that other safety provisions have been implemented.

#### 3.2 TEMPORARY SUPPORT

- A. To prevent failure provide temporary support of work to be cut.

#### 3.3 PROTECTION

- A. Protect other work during cutting and patching to prevent damage. Provide protection from adverse weather conditions for that part of the project that may be exposed during cutting and patching operations. Avoid interference with use of adjoining areas or interruption of free passage to adjoining areas.

#### 3.4 PERFORMANCE

- A. Employ skilled workmen to perform cutting and patching work. Except as otherwise indicated or as approved by the Architect/Engineer, proceed with cutting and patching at the earliest feasible time and complete work without delay.
- B. Cutting:
  - 1. Cut the work using methods that are least likely to damage work to be retained or adjoining work. Provide dust barriers to prevent dust from entering existing building beyond immediate work area. Where possible, review proposed procedures with the original installer; comply with original installer's recommendations.

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2. In general, where cutting is required, use hand or small power tools designed for sawing or grinding, not hammering and chopping. Cut through concrete and masonry using a cutting machine such as a carborundum saw or core drill to insure a neat hole. Cut holes and slots neatly to size required with minimum disturbance of adjacent work. To avoid marring existing finished surfaces, cut or drill from the exposed or finished side into concealed surfaces. Temporarily cover openings when not in use.
3. Comply with requirements of applicable sections of Division 2 where cutting and patching requires excavating and backfilling.
4. By-pass utility services such as pipe and conduit, before cutting, where such utility services are shown or required to be removed, relocated or abandoned. Cut-off conduit and pipe in walls or partitions to be removed. After by-pass and cutting, cap, valve or plug and seal tight remaining portion of pipe and conduit to prevent entrance of moisture or other foreign matter.

### C. Patching:

1. Patch with seams which are durable and as invisible as possible. Comply with specified tolerances for the work.
2. Where feasible, inspect and test patched areas to demonstrate integrity of work.
3. Restore exposed finishes of patched areas and where necessary extend finish restoration into retained adjoining work in a manner which will eliminate evidence of patching and refinishing.
4. Where removal of walls or partitions extends one finished area into another finished area, patch and repair floor and wall surfaces in the new space to provide an even surface of uniform color and appearance. If necessary to achieve uniform color and appearance, remove existing floor and wall coverings and replace with new materials.
5. Where patch occurs in a smooth painted surface, extend final paint coat over entire unbroken surface containing patch, after patched area has received prime and base coat.
6. Patch, repair or rehang existing ceilings as necessary to provide an even plane surface of uniform appearance.

## 3.5 MAINTENANCE OF TRAFFIC, ACCESS, AND UTILITIES

- A. Maintain accessibility from street at all times to any fire hydrants within construction area. Ensure that utilities serving adjacent buildings remain in service.

END OF SECTION

SECTION 01300

SUBMITTALS, MEETINGS AND RECORD DOCUMENTS

1. GENERAL

1.1 PRE-CONSTRUCTION MEETING

A. Architect will schedule a pre-construction meeting within 15 days of issuance of Notice to Proceed, to be attended by the owner, all project managers, Contractor's field superintendent, representatives of financial institutes and representatives of major sub-contractors. Within 48 hours of contract signing, CM shall submit to Owner and MaineHousing the specified pre-construction submittals including the following:

1. Typed list of sub-contractors with addresses and telephone numbers.
2. Certificates of insurance.
3. Approved construction schedule. See General Conditions, Paragraph 3.10.
4. Schedule of values.
5. Start-up authorization or certificates.
6. Completed CM Contract, Building Permits, SFMO Permits, and Bonds.

B. Pre-construction meeting agenda will include following:

1. Processing application for payment.
2. Processing and distribution of submittals.
3. Maintenance of record documents and provisions of As-Built documents.
4. Procedure for field changes, change estimates, change orders, etc.
5. Site and building security.
6. Location and maintenance of temporary storage areas, field offices, vehicular parking and access, waste disposal, etc.
7. Safety and first-aid procedures and policy for visitors and non construction personal to site.
8. Date and time for regular monthly coordination and progress meeting (to be coordinated with monthly application for payment).

1.2 CONSTRUCTION SCHEDULE

- A. Refer to General Conditions, Paragraph 3.10, for general provisions concerning construction progress schedule. Schedule shall show activities, itemized according to specification Section, and be organized in bar-chart or graph form so as to show both projected and actual progress of work.
- B. Arrange schedule to indicate required sequencing of units, and to show time allowances for submittals, inspections, and similar time margins.
- C. Show critical submittal dates related to each time bar, or prepare a separate coordinated listing of critical submittal dates.

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- D. Show phases of work within each time bar for major elements which involve purchase lead-time, fabrication, seasonal treatment, mockups, testing, or similar phases as well as installation.
- E. Submit updated schedule monthly, together with application for payment.

### 1.3 SCHEDULE OF VALUES

- A. Refer to General Conditions, Paragraph 9.2 for general provisions concerning schedule of values.
- B. For these submittals, use AIA Document G702/703, Application and Certificate for Payment.
- C. Use specifications Sections as listed in Table of Contents as basis for format for listing costs.
- D. Itemize separately general cost items, such as bonds and allowances.
- E. Itemize change orders separately as they are approved.

### 1.4 MEETINGS AND REPORTING

- A. Contractor shall conduct general progress and coordination meetings at least once each month, attended by a representative of each primary entity engaged for performance of work. Record discussions and decisions, and distribute copies to those attending and others affected, including Architect/Engineer, Owner and MaineHousing.
- B. Date and time of at least one regular monthly progress and coordination meeting shall be determined at the pre-construction meeting. Timing of this monthly meeting shall be coordinated with payment requests.

### 1.5 APPLICATION FOR PAYMENT

- A. Refer to General Conditions, Paragraph 9.3, for general provisions concerning applications for payment.
- B. Use AIA Form G702/703, fully completed and executed.
- C. Submit the forms in triplicate including attachment of waivers and similar documentation with one copy. Submit with attachments to MaineHousing.

### 1.6 SHOP DRAWINGS, PROJECT DATA, SAMPLES

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- A. Refer to General Conditions, Product Data and Samples, paragraph 3.12, for general provisions covering this type of submittal. Refer to specification section 01330 - Submittal Procedures for specific provisions for all submittals.
- B. Coordinate the preparation and processing of work-related submittals with the performance of the work. Coordinate each separate submittal with other submittals and related activities that require sequential activity. Coordinate the submittal of different units of interrelated work so that one submittal will not be delayed by the necessity of reviewing a related submittal.
- C. Architect/Engineer Review:
  - 1. Allow ten working days for the Architect/Engineer's initial processing of each submittal. Allow one week for reprocessing each submittal. No extension of time will be authorized because of failure to transmit submittals to the Architect/Engineer sufficiently in advance of the work.
  - 2. The Architect/Engineer will stamp each submittal to be returned with a uniform, self-explanatory action stamp, appropriately marked and executed to indicate the status of the submittal.
- D. Mark each submittal with a permanent label for identification. Provide project name, date, name of Architect/Engineer, name of Contractor, number and title of appropriate specification section and similar definitive information. Provide a space on the label for Contractors and Architect/Engineer's review markings.
- E. Package each submittal appropriately for transmittal and handling. Send each submittal from the Contractor to the Architect/Engineer and other destinations using AIA Transmittal Form G810.
- F. Provide additional copies of submittals required by governing authorities that are in addition to copies specified for submittal to the Architect/Engineer.
- G. Where it is necessary to provide intermediate submittals between the initial and final submittals, provide and process intermediate submittals in the same manner as for initial submittals.
- H. Submit as follows:
  - 1. Shop drawings (original drawings prepared by Contractor or sub-contractor illustrating fabrication, layout, erection details, etc.): six prints, or one reproducible transparency and one opaque print, to Architect.
  - 2. Manufacturers' specifications, installation instructions, charts, schedules, catalogs, brochures, etc.: number of copies required by Contractor for distribution, plus one copy for Architect's retention.



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3. Samples: one sample to Architect only, unless otherwise specified.
4. In submitting shop drawings and product data to Architect, use separate transmittals for material in different specification Sections, with applicable specification Section clearly numbered.
  - I. Architect will review submittals within ten working days, measured from date of receipt by Architect until date of mailing. Contractor shall promptly make corrections and resubmit when so directed. Where submittal is marked "Approved as Noted" or similar, assume that all items are approved other than those to which specific exception is taken. Do not delay fabrication, assembly and delivery pending receipt of entirely "Approved" submittal.
  - J. Distribute approved submittals to job site and record document files, and to suppliers and sub-contractors as required. Samples not designated by Contractor for incorporation into Work shall be kept on file until job completion. Any sample not reclaimed within 30 days after job completion will be considered unclaimed, and will be disposed of as directed by Architect.

### 1.7 PROJECT RECORD DOCUMENTS

- A. Keep on file at job site one complete set of up-to-date Contract Documents, including drawings and specifications, addenda, shop drawings and product data, testing data, change orders, field orders, and other modifications. Documents shall be neatly and securely stored in files or on racks, clearly indexed by trade activity or specification Section, and shall not be used for construction purposes.
- B. Legibly mark significant field changes such as following, using colored pencils or felt-tipped pens:
  1. Drawings: locations of concealed utilities, field changes of dimension and detail, changes resulting from change order or field order, and details not on original drawings.
  2. Specifications: manufacturer and model number of equipment actually installed.
  3. Shop drawings and manufacturers' literature: changes made after Architect's review.
- C. At completion of Work, deliver completed record documents to Architect. Final payment for Project will not be made until Architect reviews and approves these documents.

### 1.8 SUBSTANTIAL COMPLETION

- A. Refer to General Conditions, Article 9, Substantial Completion, for general provision concerning substantial Completion.

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- B. Following issuance by Architect/Engineer of Certificate of Substantial Completion, Contractor may submit special payment request, provided the following have been completed:
1. Obtain permits, certificates of inspection and other approval and releases by governing authorities, required for Owner's occupancy and use of project.
  2. Submit warranties and similar documentation.
  3. Submit maintenance manuals and provide instruction of Owner's operational/maintenance personnel.
  4. Complete final cleaning of the work.
  5. Submit record documents.
  6. Submit listing of work to be completed before final acceptance.
- C. Following completion of the following requirements, final payment request may be submitted:
1. Complete work listed as incomplete at time of substantial completion, or otherwise assures Owner of subsequent completion of individual incomplete items.
  2. Settle liens and other claims, or assure Owner of subsequent settlement.
  3. Submit proof of payment on fees, taxes and similar obligations.
  4. Transfer operational, access, security and similar provisions to Owner; and remove temporary facilities, tools and similar items.
  5. Completion of requirements specified in "Project Closeout" section.
  6. Obtain consent of surety for final payment.

**END OF SECTION**

SECTION 01330

SUBMITTAL PROCEDURES

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Section Includes:
  - 1. Submittal procedures.
  - 2. Product Data, Shop Drawings, and Samples.
  - 3. Assurance/Control submittals.
    - a. Certificates.
    - b. Manufacturer's installation instructions.
  - 4. Architect's action.
- B. Related Documents: The Contract Documents, as defined in Section 01110 - Summary of Work, apply to the Work of this Section. Additional requirements and information necessary to complete the Work of this Section may be found in other documents.

1.2 SUBMITTALS

- A. Submit two copies of proposed Schedule of Submittals to Contracting Officer Representative within 30 days after receipt of Notice to Proceed. List all items require submittal for review and approval by Contracting Officer.
- B. Submit two copies of final Schedule of Submittals to Contracting Officer Representative within 2 days after receipt of proposed Schedule of Submittals review from Contracting Officer.
- C. Submit schedule on Contracting Officer approved form provided to Contractor by Contracting Officer Representative.
- D. Schedule of Submittals: Include the following.
  - 1. Indicate type of submittal; product data, shop drawing, sample, certificate, or other submittal.
  - 2. Identify by Specification Section number, Specification paragraph number where item is specified, and description of item being submitted.
  - 3. Indicate scheduled date for initial submittal, date for approval, and date for possible resubmittal for each submittal.
- E. Coordinate Schedule of Submittals with Construction Schedule. Revise and update Schedule of Submittals when required by changes in the Construction Schedule. Provide Contracting Officer Representative with updated schedules within 2 days of date schedule is revised.

1.3 SUBMITTAL PROCEDURES

- A. Transmit each submittal with Contracting Officer accepted form. Submit 3 copies of each transmittal.

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- B. Sequentially number transmittal form. Revise submittals with original number and a sequential alphabetic suffix.
- C. Identify Project, Lessor, Subcontractor or supplier; pertinent drawing and detail number, and specification section number, as appropriate.
- D. Apply Contractor's stamp, signed or initialed certifying that review, verification of Products required, field dimensions, adjacent construction Work, and coordination of information, is in accordance with the requirements of the Work and Contract Documents.
- E. Schedule submittals to comply with scheduling requirements of Construction Schedule
- F. For each submittal for review, allow 10 days excluding delivery time to and from the Contractor.
- G. Identify variations from Contract Documents and Product or system limitations which may be detrimental to successful performance of the completed Work.
- H. Provide space for Contractor and Architect of Record review stamps.
- I. Revise and resubmit, identify all changes made since previous submission.
- J. Distribute copies of reviewed submittals as appropriate. Instruct parties to promptly report any inability to comply with provisions.
- K. Submittals not requested will not be recognized or processed.

### 1.4 PRODUCT DATA

- A. Product data includes printed information such as catalog cuts, manufacturer's published instructions, standard color charts, roughing-in diagrams and templates, standard wiring diagrams, performance curves and other similar items.
- A. Submit the number of copies which the Contractor requires, plus two copies which will be retained by Contracting Officer Representative and Architect of Record.
- B. Mark each copy to identify applicable products, models, options, and other data. Supplement manufacturers' standard data to provide information unique to this Project.
- C. Indicate Product utility and electrical characteristics, utility connection requirements, and location of utility outlets for service for functional equipment and appliances.

### 1.5 SHOP DRAWINGS

- A. Submit in the form of one reproducible transparency and one opaque reproduction.

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- B. Shop Drawings: Submit for review. After review, produce copies and distribute in accordance with the SUBMITTAL PROCEDURES article above.
- C. Indicate special utility and electrical characteristics, utility connection requirements, and location of utility outlets for service for functional equipment and appliances.

### 1.5 SAMPLES

- B. Submit samples to illustrate functional and aesthetic characteristics of the Product, with integral parts and attachment devices. Coordinate sample submittals for interfacing work.
- C. Submit samples of finishes in colors selected, textures, and patterns for Contracting Officer selection.
- D. Include identification on each sample, with full Project information.
- E. Submit the number of samples specified in individual specification sections; one of which will be retained by the Contracting Officer.

### 1.6 CERTIFICATES

- A. When specified in individual specification sections, submit certification by manufacturer to Contracting Officer, in quantities specified for Product Data.
- B. Indicate material or Product conforms to or exceeds specified requirements. Submit supporting reference data, affidavits, and certifications as appropriate.
- C. Certificates may be recent or previous test results on material or Product, but must be acceptable to Contracting Officer.

### 1.7 MANUFACTURER INSTALLATION INSTRUCTIONS

- A. When specified in individual specification sections, submit printed instructions for delivery, storage, assembly, installation, adjusting, and finishing, to Contracting Officer Representative in quantities specified for Product Data.
- B. Indicate special procedures, perimeter conditions requiring special attention, and special environmental criteria required for application or installation.

### 1.8 CONTRACTING OFFICER ACTION

- A. For submittals where action and return is required or requested, Contracting Officer Representative will review each submittal, mark to indicate action taken, and return promptly; generally within 10 calendar days from date of receipt.
  - 1. Compliance with specified characteristics is the Lessor's responsibility.
  - 2. Submittals for information, closeout documents, record documents and other submittals for similar purposes, no action will be taken.

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- B. Action Stamp: Architect of Record will stamp each submittal with a uniform, self-explanatory action stamp. The stamp will be appropriately marked, as follows, to indicate the action taken.
  - 1. "Accepted": Final Unrestricted Release. Where submittals are marked "Accepted", that part of the Work covered by the submittal may proceed provided it complies with requirements of the Contract Documents; final acceptance will depend upon that compliance.
  - 2. "Accepted as Noted": Final-But-Restricted Release. When submittals are marked "Accepted as Noted", that part of 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 acceptance will depend on that compliance.
  - 3. "Rejected: Submit Specified Item" or "Revise and Resubmit": Returned for Resubmittal. When submittal is marked "Rejected: Submit Specified Item", "Revise and Resubmit," do not proceed with that part of the Work covered by the submittal, including purchasing, fabrication, delivery, or other activity. Revise or prepare a new submittal in accordance with the notations; resubmit without delay. Repeat if necessary to obtain a different action mark.
    - a. Do not permit submittals marked "Rejected: Submit Specified Item" or "Revise and Resubmit," to be used at the Project site, or elsewhere where Work is in progress.
  - 4. "Returned - Not Required": Where a submittal is primarily for information or record purposes, special processing or other activity, the submittal will be returned, marked "Returned - Not Required".

PART 2 PRODUCTS

Not Used.

PART 3 EXECUTION

Not Used.

END OF SECTION

SECTION 01400

QUALITY CONTROL SERVICES

1. GENERAL

1.1 DESCRIPTION

- A. Quality control services include inspections and tests performed by independent agencies and governing authorities, as well as by the Contractor.
- B. Inspection and testing services are intended to determine compliance of the work with requirements specified.
- C. Specific quality control requirements are specified in individual specification sections.

1.2 RESPONSIBILITIES

- A. Except where indicated as being the Owner's responsibility, quality control services are the Contractor's responsibility, including those specified to be performed by an independent agency and not by the Contractor.
- B. The Contractor shall employ and pay an independent agency, testing laboratory or other qualified firm to perform quality control services specified.
- C. The Owner will engage and pay for services of an independent agency to perform the inspections and tests that are specified as Owner's responsibilities.
- D. Where results of inspections or tests do not indicate compliance with contract document, retests are the Contractor's responsibility.
- E. The Contractor shall cooperate with independent agencies performing inspections or tests. Provide auxiliary services as are reasonable. Auxiliary services include:
  - 1. Provide access to the work.
  - 2. Assist taking samples.
  - 3. Deliver samples to test laboratory.

1.3 COORDINATION

- A. The Contractor and independent test agencies shall coordinate the sequence of their activities. Avoid removing and replacing work to accommodate inspections and tests. The Contractor is responsible for scheduling times for inspections and tests.

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### **1.4 QUALIFICATIONS FOR SERVICE AGENCIES**

- A. Engage inspection and test service agencies which are prequalified as complying with "Recommended Requirements for Independent Laboratory Qualification" by the American Council of Independent Laboratories.
- B. Each agency shall be employed with the approval of the Architect/Engineer.

### **1.5 SUBMITTALS**

- A. Notify the Architect/Engineer of the testing schedule.
- B. Submit a certified written report of each inspection test or similar service, in duplicate to the Architect/Engineer. Submit additional copies of each report to governing authority, when the authority so directs.

### **1.6 REPORT DATA**

- A. Written inspection or test reports shall include:
  - 1. Name of testing agency or test laboratory.
  - 2. Dates and locations of samples, tests or inspections.
  - 3. Names of individuals present.
  - 4. Complete inspection or test data.
  - 5. Test results.
  - 6. Interpretations.
  - 7. Recommendations.
  - 8. Structural Special Inspections
- B. Reports shall be provided to the Architect/Engineer and directly to MaineHousing in a timely manner.

### **1.7 REPAIR AND PROTECTION**

- A. Upon completion of inspection or testing repair damaged work and restore substrates and finishes. Comply with requirements for "Cutting and Patching".

**END OF SECTION**



SECTION 01500

TEMPORARY FACILITIES

1. GENERAL

- 1.1 DESCRIPTION OF REQUIREMENTS: Provide temporary services and facilities ready for use when first needed to avoid delay in the work. Field office facility shall be sufficiently large to accommodate all persons and furniture/equipment convening for project meetings (progress and requisition meetings). Maintain, expand and modify as needed. Do not remove until no longer needed, or replaced by authorized use of permanent facilities.
- 1.2 USE CHARGES: Usage charges for temporary services or facilities are not chargeable to the Owner or Architect/Engineer.
- 1.3 REGULATIONS: Comply with requirements of local laws and regulations governing construction and local industry standards, in the installation and maintenance of temporary services and facilities.
- 1.4 STANDARDS: Comply with the requirements of NFPA Code 241, "Building Construction and Demolition Operations", the ANSI-A10 Series standards for "Safety Requirements for Construction and Demolition", and the NECA National Joint Guideline NJG-6 "Temporary Job Utilities and Services".
- 1.5 INSPECTIONS: Inspect and test each service before placing temporary utilities in use. Arrange for inspections and tests by governing authorities, and obtain certifications and permits for use.
- 1.6 SUBMITTALS: Submit copies of reports and permits required or necessary for installation and operation, including reports of tests, inspections and meter readings performed on temporary utilities, and permits and easements necessary for installation, use and operation.
- 1.7 MATERIALS AND EQUIPMENT
  - A. Provide materials and equipment that are suitable for the intended use.
  - B. Provide new materials and equipment for temporary services and facilities; if acceptable to the Architect/Engineer, used materials and equipment that are undamaged may be used.
- 1.8 INSTALLATION
  - A. Use qualified tradesmen for installation.
  - B. Locate temporary services and facilities where they will serve the project adequately and result in minimum interference with the work.
- 1.9 TEMPORARY UTILITY INSTALLATION

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- A. Engage, or make arrangements if necessary with, the local utility company to make connections to existing service.
- B. Arrange with the companies and existing users for an acceptable time when service can be interrupted to make connections.
- C. Establish a service implementation and termination schedule. As early as possible change to use of permanent service, to enable removal of the temporary utility and eliminate possible interference with completion of the work.
- D. Provide adequate capacity at each stage of construction. Prior to availability at the site, provide, trucked-in services for start up of construction operations.
- E. Obtain and pay for easements required to bring temporary utilities to the site, where the Owner's easement cannot be utilized for that purpose.

### 1.10 ELECTRIC POWER SERVICE

- A. Coordinate with Owner to use existing electrical service during construction.
- B. Comply with applicable requirements of NEMA, NECA and UL standards and governing regulations.
- C. Install temporary lighting of adequate illumination levels to perform the work specified.
- D. Comply with NEC pertaining to installation of temporary wiring service and grounding. Provide meters, transformers, and overcurrent protective devices at main distribution panel for power and light circuitry. Provide disconnects for equipment circuits.

### 1.11 POWER DISTRIBUTION SYSTEM

- A. Provide circuits of proper sizes, characteristics, and ratings for each use indicated.
- B. Install wiring overhead, and risers vertically where least exposed to damage.
- C. Provide rigid steel conduit to protect wiring on grade, floors, decks or other areas exposed to possible damage.
- D. Provide 20 amp, 4-gang receptacle outlets, equipped with ground-fault circuit interrupters, reset button and pilot light, spaced that a 100 foot extension cord can reach each area of work. Use only grounded extension cords; use "hard- service" cords where exposed to abrasion and traffic.
- E. Provide warning signs at power outlets that are other than 110/120 volt. Provide outlets of proper NEMA configuration to prevent insertion of 110/120 volt plugs into higher voltage outlets.

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### 1.12 TEMPORARY LIGHTING

- A. Provide general service incandescent lamps of wattage required for adequate illumination.
- B. Protect lamps with guard cages or tempered glass enclosures, where exposed to breakage.
- C. Provide exterior type fixtures where exposed to weather or moisture.
- D. Provide one 200-watt incandescent lamp per 1000 square feet of floor area for general construction lighting, one 100-watt incandescent lamp every 50 feet in corridors, and one lamp per story, located to illuminate each landing and flight in stairways.
- E. Install temporary lighting to fulfill security and protection requirements, without having to operate the entire temporary lighting system.

### 1.13 TEMPORARY TELEPHONES

- A. Install telephone for each temporary office and first aid station.
- B. At each telephone location post a list of operational and emergency telephone numbers.

### 1.14 TEMPORARY HEAT

- A. Provide temporary heat where needed for performance of work, for curing or drying of recently installed work or for protection of work in place from adverse effects of low temperatures or high humidity.
- B. Provide UL or FM tested and labeled heating units known to be safe and without adverse effect upon work in place or being installed. Coordinate with ventilation requirements to produce the ambient condition.
- C. Maintain a minimum temperature of 45 deg. F (7 deg. C) in permanently enclosed portions of the building and areas where finished work has been installed.
- D. Except where use of the permanent heating system is available and authorized, provide properly vented self-contained LP gas or fuel oil heaters with individual space thermostatic control for temporary heat. Do not use open burning or salamander type heating units.

### 1.15 FIELD OFFICES

- A. Provide standard prefabricated or mobile units, or the equivalent job-built field offices of sufficient size to accommodate required office personnel at the site.
- B. Provide insulated, weathertight units with lockable entrances.

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- C. Provide vented space heater, capable of maintaining an indoor temperature of 68 deg. F (20 deg. C).

### 1.16 SANITARY FACILITIES

- A. Sanitary facilities include temporary toilets.
- B. Comply with governing regulations including safety and health codes for the type, number, location, operation and maintenance of fixtures and facilities.
- C. Supply toilet tissue, paper towels, paper cups and similar disposable materials as appropriate for each facility. Provide covered waste containers for used material.
- D. Install single occupant self-contained toilet units of the chemical, aerated recirculation or combustion type, properly vented and fully enclosed with glass fiber reinforced polyester shell. Use of pit-type privies will not be permitted.
- E. Provide separate toilet facilities for male and female construction personnel.
- F. Provide drinking water fountains where and when piped potable water, approved by local authorities, is reasonably accessible from permanent or temporary lines. Otherwise, provide containerized tap-dispenser bottled-water type drinking water units.

- 1.17 FIRST AID SUPPLIES: Comply with governing regulations and recognized recommendations within the construction industry.

### 1.18 DEWATERING FACILITIES AND DRAINS

- A. For temporary drainage and dewatering facilities and operations not directly associated with performance of work included under other sections, comply with dewatering requirements of applicable Division-2 sections. Where feasible, utilize the same facilities.
- B. Maintain the site, excavations and construction free of water.
- C. Dispose of rainwater in a lawful manner which will not result in flooding and project or adjoining property, nor endanger either permanent work or temporary facilities.

### 1.19 TEMPORARY ENCLOSURE

- A. Provide temporary enclosure of materials, equipment, work in progress and completed portions of the Work to provide protection from exposure, foul weather, other construction operations, and similar activities.

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- B. Provide enclosures where temporary heat is needed and the permanent building enclosure is not completed, and there is no other provision for containment of heat. Coordinate with ventilating and material drying or curing requirements to avoid dangerous conditions.
- C. Provide temporary enclosures by installing waterproof, fire-resistant, UL labeled tarpaulins with a flame-spread rating of 15 or less, using a minimum of wood framing. Use translucent nylon reinforced laminated polyethylene tarpaulins to admit the maximum amount of daylight. Individual openings of 25 square feet or less may be closed with plywood or similar materials.
- D. Close openings through the floor or roof decks and other horizontal surfaces with substantial load-bearing wood-framed or similar construction.

### 1.20 COLLECTION AND DISPOSAL OF WASTES

- A. Establish a system for daily collection and disposal of waste materials, including separation and recycling of waste material. Do not hold collected materials longer than 7 days.
- B. Handle waste materials that are hazardous, dangerous, or unsanitary separately from other waste by containerizing.
- C. Burying or burning of waste materials on the site or washing waste material down sewers will not be permitted.

### 1.21 MISCELLANEOUS SERVICES AND FACILITIES

- A. Design, construct, and maintain miscellaneous services and facilities as needed to accommodate performance of the work, including temporary stairs, ramps, ladders, staging, shoring, scaffolding, temporary partitions, waste chutes and similar items.

### 1.22 SECURITY AND PROTECTION FACILITIES INSTALLATION

- A. Provide a neat and uniform appearance in security and protection facilities acceptable to the Architect/Engineer and the Owner.
- B. Maintain site in a safe, lawful and publicly acceptable manner.
- C. Take necessary measures to prevent erosion.
- D. Except for utilization of permanent fire protection facilities, as soon as available, do not change over to use of permanent facilities until substantial completion.

### 1.23 TEMPORARY FIRE PROTECTION

- A. Until fire protection needs may be fulfilled by permanent facilities, install and maintain temporary fire protection of the types needed to protect against losses.

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- B. Comply with recommendations of NFPA Standard 10.
- C. Locate fire extinguishers where most effective; provide not less than one on each floor at or near each stairwell.
- D. Provide type "A" fire extinguishers for temporary offices and spaces where there is minimal danger of electrical or flammable liquid fires, and type "ABC" dry chemical extinguishers elsewhere.
- E. Store combustible materials in containers in fire-safe locations.
- F. Review fire prevention and protection needs with local fire department officials and establish procedures to be followed in the event of fire. Instruct personnel in procedures and post warnings and information.
- G. Maintain unobstructed access to fire extinguishers, temporary fire protection facilities, stairways and other access routes.
- H. Prohibit smoking in hazardous areas.
- I. Provide supervision of welding operations, combustion type temporary heating units, and similar sources of ignition.
- J. At temporary water outlets provide hoses of sufficient length to reach construction areas. Hang hoses with a warning sign, indicating that hoses are for fire protection purposes and are not to be removed.
- K. At the earliest feasible date complete installation of the permanent fire protection facility, including connected services, and place into operation and use. Instruct key personnel at the site on how to use facilities which may not be self-explanatory.

### 1.24 BARRICADES, WARNING SIGNS AND LIGHTS

- A. Comply with recognized standards and code requirements for erection of substantial, barricades where needed to prevent accidents.
- B. Paint with appropriate colors and warning signs to inform personnel at the site and the public, of the hazard being protected against.
- C. Provide lighting where needed, including flashing red lights where appropriate.

### 1.25 SECURITY ENCLOSURE AND LOCKUP: Where materials and equipment must be temporarily stored, and are of substantial value or attractive for possible theft, provide a secure lockup.

### 1.26 ENVIRONMENTAL PROTECTION

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- A. Conduct construction activities, and by methods that comply with environmental regulations, minimize the possibility that air, waterways and subsoil might be contaminated or polluted, or that other undesirable effects might result from the performance of work at the site.
- B. Avoid the use of tools and equipment which produce harmful noise.
- C. Restrict the use of noise making tools and equipment to hours of use that will minimize complaints.

### 1.27 OPERATION, TERMINATION AND REMOVAL

- A. Limit availability of temporary services and facilities to essential and intended uses to minimize waste and abuse. Do not permit temporary installations to be abused or endangered.
- B. Operate and maintain temporary services and facilities in good operating condition and in a safe and efficient manner until removal is authorized. Do not overload services or facilities. Protect from damage by freezing temperatures and similar elements.
- C. Do not allow unsanitary conditions, public nuisances or hazardous conditions to develop or persist on the site.
- D. Maintain operation of temporary enclosures, heating, cooling, humidity control, ventilation and similar facilities on a 24- hour basis where required to achieve indicated results and avoid the possibility of damage to the Work or to temporary facilities.
- E. Prevent water filled piping from freezing. Maintain markers for underground lines. Protect from damage during excavation.
- F. Remove each temporary service and facility promptly when need has ended, or when replaced by use of a permanent facility, but no later than substantial completion. Complete, or, if necessary, restore permanent work delayed because of interference with the temporary service or facility. Repair damaged work, clean exposed surfaces and replace work which cannot be repaired.
- G. At substantial completion, clean and renovate permanent services and facilities that have been used to provide temporary services and facilities during the construction period.

END OF SECTION

SECTION 01631

PRODUCTS AND SUBSTITUTIONS

1. GENERAL

1.1 PROCEDURAL REQUIREMENTS

A. Source Limitations:

1. To the fullest extent possible, provide products of the same generic kind, from a single source, for each unit of work. Where it is not possible to do so, match separate procurements as closely as possible.
2. To the extent that the product selection process is under the Contractor's control, provide products that are compatible with previously selected products.
3. Where standard products are available that comply with specified requirements, provide those standard products that have been used successfully before in similar applications, and that are recommended by the manufacturers for the applications indicated.

1.2 PRODUCT SELECTION LIMITATIONS

A. Product Selections: Comply with the following requirements in the selection of products, materials and equipment:

1. Single Product Name: Where only a single product or manufacturer is named, provide the product, unless it is not available, is incompatible with existing work, or does not comply with specified requirements or governing regulations.
2. Two or More Products Named: Where two or more products or manufacturers are named, the selection is at the Contractor's option, provided the product selected complies with specified requirements.
3. "Or Approved Equal" Provisions: Where products or manufacturers are specified by name accompanied by the term "or approved equal", provide either the product named, or comply with the requirements for gaining approval of "substitutions" for the use of an unnamed product.
4. Compliance with Standards: Where the specifications require only compliance with an imposed standard, code or regulation, the Contractor has the option of selecting any product that complies with specified requirements provided no product names are indicated.



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5. Performance Requirements: Where the specifications require compliance with indicated performance requirements, the Contractor has the option of selecting any product that complies with the specific performance requirements, provided no product names are indicated.
  6. Visual Requirements: Where the specifications indicate that a product is to be selected from the manufacturer's standard options, without naming the manufacturer, the Architect/Engineer has the option of making the selection, after the Contractor has determined or selected the manufacturer.
- B. Nameplates: Except as otherwise indicated for required labels and operating data, do not permanently attach or imprint manufacturer's or producer's nameplates or trademarks on exposed surfaces of products which will be exposed to view either in occupied spaces or on the exterior of the completed project.

### 1.3 SUBSTITUTIONS

- A. Conditions: The Contractor's requests for substitutions will be considered when they are reasonable, timely, fully documented, and when they qualify under one or more of the following circumstances.
1. The proposed substitution is related to an "or approved equal" or similar provision in the contract documents.
  2. The required product cannot be supplied in time for compliance with Contract Time requirements.
  3. The required product is not acceptable to governing authorities.
  4. The required product cannot be properly coordinated with other materials in the work, or cannot be warranted or insured as specified.
  5. The proposed substitution will offer a substantial advantage to the Owner after deducting offsetting disadvantages including delays, additional compensation to the Architect/Engineer for redesign, evaluation and other necessary services, and similar considerations.
- B. Submittals: Include the following information, as appropriate, in each request for substitution:
1. Provide complete product documentation, including product data and samples, where appropriate.
  2. Provide detailed performance comparisons and evaluation, including testing laboratory reports where applicable.

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3. Provide coordination information indicating the effect of the substitution on other work and the time schedule.
4. Provide cost information for the proposed change order.
5. Provide the Contractor's general certification of the recommended substitution.

### **1.4 DELIVERY, STORAGE, AND HANDLING**

- A. Receive, store and handle products, materials and equipment in a manner which will prevent loss, deterioration and damage.
- B. Schedule deliveries so as to minimize long-term storage at the project site.

END OF SECTION

SECTION 01700

PROJECT CLOSEOUT

1. GENERAL

1.1 DESCRIPTION OF REQUIREMENTS

- A. Provisions of this section apply to the procedural requirements for the actual closeout of the Work, not to administrative matters such as final payment or the change over of insurance.
- B. Closeout requirements relate to both substantial and final completion of the Work; they also apply to individual portions of completed work as well as the total Work.
- C. Specific requirements contained in other sections have precedence over the general requirements contained in this section.
- D. MaineHousing Closeout Requirements – comply with the following MSHA requirements: See the following MSHA documents attached to this Section: Final Completion Check List, Certifications, Final Requisition, Incomplete Work Escrow.

1.2 PROCEDURES AT SUBSTANTIAL COMPLETION

- A. Prerequisites: Comply with General Conditions and complete the following before requesting Architect's/Engineer's inspection of the Work, or a designated portion of the Work, for certification of substantial completion.
  - 1. Submit executed warranties, workmanship bonds, maintenance agreements, inspection certificates and similar required documentation for specific units of work, enabling owner's unrestricted occupancy and use.
  - 2. Submit record documentation, maintenance manuals, tools, spare parts, keys and similar operational items.
  - 3. Complete instruction of Owner's operating personnel, and start-up of systems.
  - 4. Complete final cleaning, and remove temporary facilities and tools.
- B. Inspection Procedures:
  - 1. Upon receipt of Contractor's request, Architect/Engineer will either proceed with inspection or advise Contractor of prerequisites not fulfilled.

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2. Following initial inspection, Architect/Engineer will either prepare certificate of substantial completion, or advise Contractor of work which must be performed prior to issuance of the certificate of substantial completion.
3. The Architect/Engineer will repeat the inspection when requested and assure that the Work has been substantially completed.
4. Results of the completed inspection will form the initial "punch-list" for final acceptance.

### 1.3 PROCEDURES AT FINAL ACCEPTANCE

#### A. Reinspection Procedure:

1. The Architect/Engineer will reinspect the Work upon receipt of the Contractor's notice that, except for those items whose completion has been delayed due to circumstances that are acceptable to the Architect/Engineer, the Work has been completed, including punch-list items from earlier inspections.
2. Upon completion of reinspection, the Architect/Engineer will either recommend final acceptance and final payment, or will advise the Contractor of work not completed or obligations not fulfilled as required for final acceptance. If necessary, this procedure will be repeated.

### 1.4 RECORD DOCUMENTATION

#### A. Record Drawings:

1. Maintain a complete set of either blue- or black-line prints of the contract drawings and shop drawing for record mark-up purposes throughout the Contract Time.
2. Mark-up these drawings during the course of the work to show both changes and the actual installation, in sufficient detail to form a complete record for the Owner's purposes. Give particular attention to work which will be concealed and difficult to measure and record at a later date, and work which may require servicing or replacement during the life of the project.
3. Require the entities marking prints to sign and date each mark-up.
4. Bind prints into manageable sets, with durable paper covers, appropriately labeled.

#### B. Maintenance Manuals:

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1. Provide 3-ring vinyl-covered binders containing required maintenance manuals, properly identified and indexed.
2. Include operating and maintenance instructions extended to cover emergencies, spare parts, warranties, inspection procedures, diagrams, safety, security, and similar appropriate data for each system or equipment item.

### 1.5 GENERAL CLOSEOUT REQUIREMENTS

- A. Operator Instructions: Require each Installer of systems requiring continued operation and maintenance by owner's operating personnel, to provide on-location instruction to Owner's personnel, sufficient to ensure safe, secure, efficient, non-failing utilization and operation of systems. Provide instructions for the following categories of work:
1. Mechanical/electrical/electronic systems (not limited to work of Divisions 15 and 16).
  2. Live plant materials and lawns.
  3. Roofing, flashing, joint sealers.
  4. Floor finishes.
- B. Final Cleaning: At the time of project close out, clean or reclean the Work to the condition expected from a normal, commercial building cleaning and maintenance program. Complete the following cleaning operations before requesting the Architect/Engineer's inspection for certification of substantial completions.
1. Remove non-permanent protection and labels.
  2. Polish glass.
  3. Clean exposed finishes.
  4. Touch-up minor finish damage.
  5. Clean or replace mechanical systems filters.
  6. Remove debris.
  7. Broom-clean unoccupied spaces.
  8. Sanitize plumbing and food service facilities.
  9. Clean light fixtures and replace burned-out lamps.
  10. Sweep and wash paved areas.
  11. Police yards and grounds

END OF SECTION

SECTION 01 56 39

TEMPORARY TREE AND PLANT PROTECTION

**PART 1 - GENERAL**

1.1 SUMMARY

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

1.2 SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Tree Pruning Schedule: Written schedule from arborist detailing scope and extent of pruning of trees to remain that interfere with or are affected by construction.
- C. Certification: From arborist, certifying that trees indicated to remain have been protected during construction according to recognized standards and that trees were promptly and properly treated and repaired when damaged.
- D. Maintenance Recommendations: From arborist, for care and protection of trees affected by construction during and after completing the Work.

1.3 QUALITY ASSURANCE

- A. Arborist Qualifications: An arborist certified by ISA or licensed in the jurisdiction where Project is located.
- B. Tree Pruning Standard: Comply with ANSI A300 (Part 1), "Tree, Shrub, and Other Woody Plant Maintenance--Standard Practices (Pruning)."

**PART 2 - PRODUCTS**

2.1 MATERIALS

- A. Drainage Fill: Selected crushed stone, or crushed or uncrushed gravel, washed, ASTM D 448, Size 24, with 90 to 100 percent passing a 2-1/2-inch sieve and not more than 10 percent passing a 3/4-inch sieve.
- B. Topsoil: Natural or cultivated surface-soil layer containing organic matter and sand, silt, and clay particles; friable, pervious, and black or a darker shade of brown, gray, or red than underlying subsoil; reasonably free of subsoil, clay lumps, gravel, and other objects more than 1/2 in. diameter; and free of weeds, roots, and toxic and other non-soil materials.
  - 1. Obtain topsoil only from well-drained sites where topsoil is 4 inches deep or more; do not obtain from bogs or marshes except for wetland creation areas. Avoid and do not obtain topsoil where extensive weeds or bamboo have grown in the past.

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- C. Filter Fabric: Manufacturer's standard, nonwoven, pervious, geotextile fabric of polypropylene, nylon, or polyester fibers.
- D. Orange Safety Fence: Open web polypropylene fence with a 4'-0" height. Support with 8'-0" long #6 rebar driven at 6'-0" on center; 4'-0" into ground. Secure fence to rebar with cable ties.
- E. Organic Mulch: Wood and bark chips, free from deleterious materials.

### PART 3 - EXECUTION

#### 3.1 PREPARATION

- A. Temporary Fencing: Install temporary fencing around tree protection zones to protect remaining trees and vegetation from construction damage. Maintain temporary fence and remove when construction is complete.
- B. Protect tree root systems from damage caused by runoff or spillage of noxious materials while mixing, placing, or storing construction materials. Protect root systems from ponding, eroding, or excessive wetting caused by dewatering operations.
- C. Mulch areas inside tree protection zones and within drip line of trees to remain and other areas indicated.
  - 1. Apply average thickness of organic mulch. Do not place mulch within 6 inches of tree trunks.
- D. Do not store construction materials, debris, or excavated material inside tree protection zones. Do not permit vehicles or foot traffic within tree protection zones; prevent soil compaction over root systems.
- E. **Notify Owners Representative and Engineer when tree protection measures are in place and prior to commencement of construction activities. Engineer shall review and approve tree protection measures prior to the start of construction.**

#### 3.2 EXCAVATION

- A. Install shoring or other protective support systems to minimize sloping or benching of excavations.
- B. Do not excavate within tree protection zones, unless otherwise indicated.
- C. Where utility trenches are required within tree protection zones, tunnel under or around roots by drilling, auger boring, pipe jacking, or digging by hand.
  - 1. Root Pruning: Do not cut main lateral roots or taproots; cut only smaller roots that interfere with installation of utilities. Cut roots with sharp pruning instruments; do not break or chop.

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### 3.3 REGRADING

- A. Grade Lowering: Where new finish grade is indicated below existing grade around trees, slope grade beyond tree protection zones. Maintain existing grades within tree protection zones.
- B. Minor Fill: Where existing grade is 6 inches or less below elevation of finish grade, fill with topsoil. Place topsoil in a single uncompacted layer and hand grade to required finish elevations.
- C. Moderate Fill: Where existing grade is more than 6 inches but less than 12 inches below elevation of finish grade, place drainage fill, filter fabric, and topsoil on existing grade as follows:
  - 1. Carefully place drainage fill against tree trunk approximately 2 inches above elevation of finish grade and extend not less than 18 inches from tree trunk on all sides. For balance of area within drip-line perimeter, place drainage fill up to 6 inches below elevation of grade.
  - 2. Place filter fabric with edges overlapping 6 inches minimum.
  - 3. Place fill layer of topsoil to finish grade. Do not compact drainage fill or topsoil. Hand grade to required finish elevations.

### 3.4 TREE PRUNING

- A. Prune trees to remain that are affected by temporary and permanent construction.
- B. Prune trees to remain to compensate for root loss caused by damaging or cutting root system. Provide subsequent maintenance during Contract period as recommended by arborist.
- C. Pruning Standards: Prune trees according to ANSI A300 (Part 1).
  - 1. Type of Pruning: Cleaning and Thinning.
  - 2. Specialty Pruning: Vista.
- D. Cut branches with sharp pruning instruments; do not break or chop.
- E. Chip removed tree branches and stockpile in areas approved by Engineer/Owner's Representative.

### 3.5 TREE REPAIR AND REPLACEMENT

- A. Promptly repair trees damaged by construction operations within 24 hours. Treat damaged trunks, limbs, and roots according to arborist's written instructions.

### 3.6 DISPOSAL OF WASTE MATERIALS

- A. Disposal: Remove excess excavated material and displaced trees from Owner's property.

**END OF SECTION**



SECTION 01 70 00.01

SITE PERMIT REQUIREMENTS

**PART 1 - GENERAL**

- A. Construction of this project must meet the terms and conditions of a City of Portland Site Plan Permit. The Owner has applied for this permit. This permit is provided to the contractor in Attachment A. The aforementioned permit shall be the extent of Owner supplied permits. Any other permits required to conduct the work shall be obtained by the Contractor.
- B. Some of the permits may require inspection or the work by the Owner or Engineer. The contractor shall review these requirements and provide the Owner a minimum of 48 hours prior to the need for a specified inspection. The Owner will respond and arrange for a time for the inspections to occur. It is the responsibility of the Contractor to have these inspections performed during the course of the work.
- C. Copies of the Permit Applications and correspondence during review of the permits may be inspected during normal working hours at the office of:

Stantec Consulting Services Inc.  
482 Payne Road, Scarborough Court  
Scarborough, Maine  
celina.daniell@stantec.com

- D. Any Contractor who desires to view the Permit Applications and Associated Correspondence must contact Stantec 48 hours prior to inspecting the information.
- E. Certain conditions of the permits will be the responsibility of the Contractor. The Contractor is responsible for familiarizing himself with all specific and standard conditions of the permits issued for the project, and for undertaking all work in strict conformance with these.
- F. A copy of the permit and the approved plans shall be available at the Project Site at all times.
- G. A copy of all erosion inspection logs, reports and meeting minutes shall be available at the Project Site at all times.

**PART 2 - PERMITS**

- A. The City of Portland Site Plan Permit.

**END OF SECTION**

**ATTACHMENT A**

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**CITY OF PORTLAND SITE PLAN PERMIT**

SECTION 01 70 00.02

CIVIL ENGINEERING REQUESTS FOR INFORMATION

**PART 1 - GENERAL**

1.1 SUMMARY

A. Section Includes:

1. Administrative and procedural requirements for handling and processing "Requests for Information" (RFI).
2. "Request for Information" form is attached at the end of this Section.
3. Request/limit of use for AutoCAD files.
4. "Electronic Document Transfer Agreement" form is attached at the end of this Section.

1.2 DEFINITION

- A. Requests for Information: A formal process used during the construction phase to facilitate communication between the contractor, the Owner's representative, the Architect's Clerk of the Works, and the Civil Engineer with regard to requests for additional information and clarification of the intent of the Contract Documents (Drawings and Specifications).
- B. Do not use "Request for Information" form during bidding. Direct questions during bidding phase as indicated in the bid documents.

1.3 PROCEDURE

A. Conditions Requiring Clarification and the Contract Documents:

1. Contractor shall submit a "Request for Information" to the Owner and request review by the Civil Engineer.
  2. Submit "Request for Information" from the Contractor's office or field office only. "Requests for Information" submitted directly from subcontractors or suppliers will not be accepted.
  3. Generate "Requests for Information" by one source per project and number accordingly.
  4. Submit one "Request for Information" per form.
- B. Engineer will review RFI from the Contractor with reasonable promptness and the Contractor will be notified in writing of decisions made.

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1. The Engineering Consultant's written response to the RFI shall not be considered as a Change Order or Change Directive, nor does it authorize changes in the Contract Sum or Contract Time.
- C. Contractor shall maintain a log of "Requests for Information" sent to, and responses from Engineer "Requests for Information" log shall be sent, by Fax, every Friday to the Engineer.
- D. All "Requests for Information" regarding scheduling, costing, and Owner provided equipment coordination shall be directed to the Architect.

### **1.4 REQUEST FOR INFORMATION FORM**

- A. Submit "Requests for Information" on the attached "Request for Information" form, or format accordingly on letterhead. Engineer will not respond to requests for information unless this form or format is utilized.
- B. Where submittal form or format does not provide space needed for complete information, additional sheets may be attached.

### **1.5 REQUEST FOR ELECTRONIC MEDIA**

- A. Contractors may request AutoCAD disks for use in determining earthwork quantities. Contractors may obtain these disks by submitting the enclosed "Electronic Document Transfer Agreement" form to the Architect. This form restricts the use of this data.
- B. The computer aided design file represents the work product of Stantec Consulting Services Inc. Certain files and information are considered proprietary and are not to be released to any third party.
- C. Contractors acknowledge that CAD files may include embedded information, have varying degrees of layer management, and are subject to limitations in the software systems.

**END OF SECTION**

**SECTION 01 71 23.13**

**LAYOUT OF WORK**

**PART 1 - GENERAL**

**1.1 GENERAL PROVISIONS**

- A. The City of Portland has established a project benchmark and elevation as shown and identified on the project plans. For the purposes of this specification, this shall be the limit of Owner provided survey control to the contractor. The datum is NGVD 1929.
- B. The Contractor shall employ a licensed land surveyor in the State of Maine to lay out the work from the established reference points, benchmarks, and the coordinate system indicated on the drawings, and shall be responsible for all measurements in connection with the layout. AutoCAD 2014 files will be furnished to the Contractor upon written request upon signing a limit of use form. The licensed land surveyor shall certify in writing that the layout was performed under his/her direct supervision and is correct and meets the requirements of the contract documents. A copy of the certificate shall be furnished to the Engineer.

The Contractor is responsible for confirming elevation by cross checking the two benchmarks.

The Contractor shall furnish, at Contractor's own expense, all stakes, templates, platforms, equipment, tools, materials, and labor required to lay out any part of the work. The Contractor shall be responsible for executing the work to the lines and grades that may be established or indicated by the Owner. The Contractor shall also be responsible for maintaining and preserving all stakes and other marks established by the Owner until authorized to remove them. If such marks are destroyed by the Contractor or through Contractor's negligence before their removal is authorized, the Owner may replace them and deduct the expense of the replacement from any amounts due or to become due to the Contractor.

- C. The layout shall establish the locations of silt fence and areas of clearing shall be delineated for review and approval of the Owner prior to clearing.
- D. Establish and plainly mark centerlines for the site work and such other lines and grades that are reasonably necessary to properly assure that location, orientation, and elevations established for each athletic field, access drive, utilities, and parking lots, are in accordance with lines and elevations shown on contract drawings.
- E. Following completion of general mass excavation and before any other permanent work is performed, establish and plainly mark sufficient additional survey control points or system of points as may be necessary to assure proper alignment, orientation, and grade of all major features of work.
  - 1. Such additional survey control points or system of points thus established shall be checked and certified by a registered land surveyor or registered civil engineer. Furnish such certification to the Owner before any work is placed.

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2. A detailed check of all coordinates, resultant pipe lengths, backslopes, and appurtenant locations shall be made by the registered land surveyor or civil engineer and provided to the Owner prior to starting utility lines.
- F. During progress of work, the Contractor shall have line grades and plumbness of all major work checked and certified by a registered land surveyor or registered civil engineer as meeting requirements of contract drawings. Furnish such certification to the Owner before any major items are placed. In addition, Contractor shall furnish to the Owner certificates from a registered land surveyor or registered civil engineer that the following work is complete in every respect as required by contract drawings.
1. Elevations of all parking, driveway, and walkways.
  2. Lines and elevations of sewers, storm drains, utility systems.
  3. Lines of elevations of all swales and drainage areas.
  4. Lines of elevations of parking area.
  5. Horizontal alignment of all access drives.
  6. Record conditions of the stormwater management system.
- G. Record Data:
1. The Contractor shall record the following information for buried utilities:
    - The location of all appurtenances and controls including control or shutoff valves, angle points or bends, manholes, handholes, and inlets.
  2. All information shall be identified on a CAD reproducible drawing by a number or letter with a schedule of locations by coordinates tied to the Maine State Coordinate Grid. The final record drawings shall be delivered to the Owner. Two copies are required.
- H. The location of catch basins and manholes shall be accurately located by a registered land surveyor. Catch basins and manholes shall be located from the layout data and established on the contract drawings.
- I. Whenever approved changes from contract drawings are made in line or grading requiring certificates, record such changes on a reproducible drawing bearing the registered land surveyor or registered civil engineer seal, and forward these drawings upon completion of work to the Engineer.
- J. Changes in location, additions and appurtenant items such as, but not limited to, manholes, inlets, pipe lines and conduits shall be shown in same manner as on contract drawings (by coordinates or dimensions from buildings); however, if no such locations are shown on contract drawings, changes in locations of items shall be shown by a sufficient number of right-angled dimensions from the nearest building.

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- K. Contractor is responsible for all costs associated with layout of work, and any costs associated with correcting non-conforming work or with restoring the landscape to its original condition.
- L. The survey data obtained for this section shall be incorporated into the project record drawings and profiles.

**END OF SECTION**

SECTION 01 74 19

CONSTRUCTION WASTE MANAGEMENT AND DISPOSAL

PART 1 - GENERAL

1.1 SUMMARY

- A. Section includes administrative and procedural requirements for the following:
  - 1. Salvaging nonhazardous demolition and construction waste.
  - 2. Recycling nonhazardous demolition and construction waste.
  - 3. Disposing of nonhazardous demolition and construction waste.
  
- B. Related Requirements:
  - 1. Section 024116 "Structure Demolition" for disposition of waste resulting from demolition of buildings, structures, site improvements, and for disposition of hazardous waste.
  - 2. Section 024119 "Selective Demolition" for disposition of waste resulting from partial demolition of buildings, structures, and site improvements, and for disposition of hazardous waste.
  - 3. Section 026000 "Excavated Material Management" for special requirements attendant with potential contaminated soils and groundwater at the site.
  - 4. Section 311000 "Site Clearing" for disposition of waste resulting from site clearing and removal of above- and below-grade improvements.
  - 5. Divisions 01 through 33 Sections for requirements specific to the work of each of these Sections.

1.2 DEFINITIONS

- A. Construction Waste: Building and site improvement materials and other solid waste resulting from construction, remodeling, renovation, or repair operations. Construction waste includes packaging.
  
- B. Demolition Waste: Building and site improvement materials resulting from demolition or selective demolition operations.
  
- C. Disposal: Removal off-site of demolition and construction waste and subsequent sale, recycling, reuse, or deposit in landfill or incinerator acceptable to authorities having jurisdiction.
  
- D. Recycle: Recovery of demolition or construction waste for subsequent processing in preparation for reuse.



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- E. Salvage: Recovery of demolition or construction waste and subsequent sale or reuse in another facility.
- F. Salvage and Reuse: Recovery of demolition or construction waste and subsequent incorporation into the Work.

### 1.3 PERFORMANCE REQUIREMENTS

- A. General: Achieve end-of-Project rates for salvage/recycling of 75 percent by weight of total non-hazardous solid waste generated by the Work. Facilitate recycling and salvage of materials.

### 1.4 ACTION SUBMITTALS

- A. Waste Management Plan: Submit plan within 7 days of date established for Notice to Proceed.

### 1.5 INFORMATIONAL SUBMITTALS

- A. Waste Reduction Progress Reports: Concurrent with each Application for Payment, submit report. Include the following information:
  - 1. Material category.
  - 2. Generation point of waste.
  - 3. Total quantity of waste in tons.
  - 4. Quantity of waste salvaged, both estimated and actual tons.
  - 5. Quantity of waste recycled, both estimated and actual in tons.
  - 6. Total quantity of waste recovered (salvaged plus recycled) in tons.
  - 7. Total quantity of waste recovered (salvaged plus recycled) as a percentage of total waste.
- B. Waste Reduction Calculations: Before request for Substantial Completion, submit calculated end-of-Project rates for salvage, recycling, and disposal as a percentage of total waste generated by the Work.
- C. Records of Donations: Indicate receipt and acceptance of salvageable waste donated to individuals and organizations. Indicate whether organization is tax exempt.
- D. Records of Sales: Indicate receipt and acceptance of salvageable waste sold to individuals and organizations. Indicate whether organization is tax exempt.
- E. Recycling and Processing Facility Records: Indicate receipt and acceptance of recyclable waste by recycling and processing facilities licensed to accept them. Include manifests, weight tickets, receipts, and invoices.

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- F. Landfill and Incinerator Disposal Records: Indicate receipt and acceptance of waste by landfills and incinerator facilities licensed to accept them. Include manifests, weight tickets, receipts, and invoices.
- G. LEED Submittal (N.I.C.): LEED letter template for Credit MR 2.2, signed by Contractor, tabulating total waste material, quantities diverted and means by which it is diverted, and statement that requirements for the credit have been met.
- H. Qualification Data: For waste management coordinator.

### 1.6 QUALITY ASSURANCE

- A. Waste Management Coordinator Qualifications (N.I.C.): LEED-Accredited Professional, certified by USGBC. A waste management coordinator may also serve as LEED coordinator.
- B. Waste Management Conference: Conduct conference at Project site to comply with requirements in Section 013100 "Project Management and Coordination."

### 1.7 WASTE MANAGEMENT PLAN

- A. General: Develop a waste management plan according to ASTM E 1609 and requirements in this Section. Plan shall consist of waste identification, waste reduction work plan, and cost/revenue analysis. Indicate quantities by weight or volume, but use same units of measure throughout waste management plan.
- B. Waste Identification: Indicate anticipated types and quantities of demolition, site clearing, and construction waste generated by the Work. Include estimated quantities and assumptions for estimates.
- C. Waste Reduction Work Plan: List each type of waste and whether it will be salvaged, recycled, or disposed of in landfill or incinerator. Include points of waste generation, total quantity of each type of waste, quantity for each means of recovery, and handling and transportation procedures.
  - 1. Salvaged Materials for Reuse: For materials that will be salvaged and reused in this Project, describe methods for preparing salvaged materials before incorporation into the Work.
  - 2. Salvaged Materials for Sale: For materials that will be sold to individuals and organizations, include list of their names, addresses, and telephone numbers.
  - 3. Salvaged Materials for Donation: For materials that will be donated to individuals and organizations, include list of their names, addresses, and telephone numbers.
  - 4. Recycled Materials: Include list of local receivers and processors and type of recycled materials each will accept. Include names, addresses, and telephone numbers.
  - 5. Disposed Materials: Indicate how and where materials will be disposed of. Include name, address, and telephone number of each landfill and incinerator facility.

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6. Handling and Transportation Procedures: Include method that will be used for separating recyclable waste including sizes of containers, container labeling, and designated location where materials separation will be performed.

### PART 2 - PRODUCTS (Not Used)

### PART 3 - EXECUTION

#### 3.1 PLAN IMPLEMENTATION

- A. General: Implement approved waste management plan. Provide handling, containers, storage, signage, transportation, and other items as required to implement waste management plan during the entire duration of the Contract.
- B. Waste Management Coordinator: Engage a waste management coordinator to be responsible for implementing, monitoring, and reporting status of waste management work plan.
- C. Training: Train workers, subcontractors, and suppliers on proper waste management procedures, as appropriate for the Work occurring at Project site.
  1. Distribute waste management plan to everyone concerned within three days of submittal return.
  2. Distribute waste management plan to entities when they first begin work on-site. Review plan procedures and locations established for salvage, recycling, and disposal.
- D. Site Access and Temporary Controls: Conduct waste management operations to ensure minimum interference with roads, streets, walks, walkways, and other adjacent occupied and used facilities.
  1. Designate and label specific areas on Project site necessary for separating materials that are to be salvaged, recycled, reused, donated, and sold.
  2. Comply with Section 015000 "Temporary Facilities and Controls" for controlling dust and dirt, environmental protection, and noise control.

#### 3.2 SALVAGING DEMOLITION WASTE

- A. Salvaged Items for Reuse in the Work:
  1. Clean salvaged items.
  2. Pack or crate items after cleaning. Identify contents of containers.
  3. Store items in a secure area until installation.
  4. Protect items from damage during transport and storage.
  5. Install salvaged items to comply with installation requirements for new materials and equipment. Provide connections, supports, and miscellaneous materials necessary to make items functional for use indicated.

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- B. Salvaged Items for sale and donation are not permitted on Project site.
- C. Salvaged Items for Owner's Use:
  - 1. Clean salvaged items.
  - 2. Pack or crate items after cleaning. Identify contents of containers.
  - 3. Store items in a secure area until delivery to Owner.
  - 4. Transport items to Owner's storage area onsite designated by Owner.
  - 5. Protect items from damage during transport and storage.

### 3.3 RECYCLING DEMOLITION AND CONSTRUCTION WASTE, GENERAL

- A. General: Recycle paper and beverage containers used by on-site workers.
- B. Procedures: Separate recyclable waste from other waste materials, trash, and debris. Separate recyclable waste by type at Project site to the maximum extent practical according to approved construction waste management plan.
  - 1. Provide appropriately marked containers or bins for controlling recyclable waste until they are removed from Project site. Include list of acceptable and unacceptable materials at each container and bin.
    - a. Inspect containers and bins for contamination and remove contaminated materials if found.
  - 2. Stockpile processed materials on-site without intermixing with other materials. Place, grade, and shape stockpiles to drain surface water. Cover to prevent windblown dust.
  - 3. Stockpile materials away from construction area. Do not store within drip line of remaining trees.
  - 4. Store components off the ground and protect from the weather.
  - 5. Remove recyclable waste from Owner's property and transport to recycling receiver or processor.

### 3.4 RECYCLING DEMOLITION WASTE

- A. Asphalt Paving (N.I.C.): Grind asphalt in accordance with Section 024221 Reclaimed Stabilized Base.
- B. Concrete (N.I.C.): Remove reinforcement and other metals from concrete and sort with other metals in accordance with Section 024200 Aggregate Material from Recycling.
  - 1. Pulverize concrete to maximum Section 024200 Aggregate Material from Recycling.
- C. Masonry: Remove metal reinforcement, anchors, and ties from masonry and sort with other metals.
  - 1. Pulverize masonry to maximum Section 024200 Aggregate Material from Recycling.

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- D. Wood Materials: Sort and stack members according to size, type, and length. Separate lumber, engineered wood products, panel products, and treated wood materials.
- E. Metals: Separate metals by type.
  - 1. Structural Steel: Stack members according to size, type of member, and length.
  - 2. Remove and dispose of bolts, nuts, washers, and other rough hardware.
- F. Asphalt Shingle Roofing: Separate organic and glass-fiber asphalt shingles and felts. Remove and dispose of nails, staples, and accessories.
- G. Gypsum Board: Stack large clean pieces on wood pallets or in container and store in a dry location. Remove edge trim and sort with other metals. Remove and dispose of fasteners.
- H. Acoustical Ceiling Panels and Tile: Stack large clean pieces on wood pallets and store in a dry location.
- I. Metal Suspension System: Separate metal members including trim, and other metals from acoustical panels and tile and sort with other metals.
- J. Carpet: Roll large pieces tightly after removing debris, trash, adhesive, and tack strips.
  - 1. Store clean, dry carpet in a closed container or trailer provided by Carpet Reclamation Agency or carpet recycler.
- K. Carpet Tile: Remove debris, trash, and adhesive.
  - 1. Stack tile on pallet and store clean, dry carpet in a closed container or trailer provided by Carpet Reclamation Agency or carpet recycler.
- L. Piping: Reduce piping to straight lengths and store by type and size. Separate supports, hangers, valves, sprinklers, and other components by type and size.
- M. Conduit: Reduce conduit to straight lengths and store by type and size.

### 3.5 RECYCLING CONSTRUCTION WASTE

- A. Packaging:
  - 1. Cardboard and Boxes: Break down packaging into flat sheets. Bundle and store in a dry location.
  - 2. Polystyrene Packaging: Separate and bag materials.
  - 3. Pallets: As much as possible, require deliveries using pallets to remove pallets from Project site. For pallets that remain on-site, break down pallets into component wood pieces and comply with requirements for recycling wood.
  - 4. Crates: Break down crates into component wood pieces and comply with requirements for recycling wood.

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- B. Wood Materials:
  - 1. Clean Cut-Offs of Lumber: Grind or chip into small pieces.
  - 2. Clean Sawdust: Bag sawdust that does not contain painted or treated wood.
- C. Gypsum Board: Stack large clean pieces on wood pallets or in container and store in a dry location.
  - 1. Clean Gypsum Board: Grind scraps of clean gypsum board using small mobile chipper or hammer mill. Screen out paper after grinding.

### 3.6 DISPOSAL OF WASTE

- A. General: Except for items or materials to be salvaged, recycled, or otherwise reused, remove waste materials from Project site and legally dispose of them in a landfill or incinerator acceptable to authorities having jurisdiction.
  - 1. Except as otherwise specified, do not allow waste materials that are to be disposed of accumulate on-site.
  - 2. Remove and transport debris in a manner that will prevent spillage on adjacent surfaces and areas.
- B. Burning: Do not burn waste materials.
- C. Disposal: Remove waste materials from Owner's property and legally dispose of them in accordance with the Environmental Work Plan prepared by Ransom Consulting (Refer to Section 026000 Excavated Material Management).

### 3.7 SAMPLE FORMS

- A. Owner will review and provide sample templates at the preconstruction conference.

**END OF SECTION**

**SECTION 02 32 00**

**GEOTECHNICAL INVESTIGATIONS**

**PART 1 - GENERAL**

**1.1 GENERAL PROVISIONS**

- A. Related Documents: Drawings and General Provisions of Contract, including General and Supplementary Conditions apply to work of this Section.

**1.2 DESCRIPTION OF WORK**

- A. Contractor shall review the Geotechnical Report prepared for the project by Summit Geoengineering Services appended to this section of Project Specifications. During the Bidding Process, the Contractor may conduct his own subsurface investigations after requesting and receiving prior approval from the Owner. The request for approval shall be accompanied by a plan indicating the location and type of investigations to be undertaken by the Contractor. The Contractor is encouraged to verify Owner's subsurface investigations and shall notify the Owner in writing prior to the bid date of any discrepancies.

**PART 2 - PRODUCTS**

**2.1 REPORT**

- A. Subsurface conditions have been investigated by test pits and borings. Locations of the test pits and borings are shown on the contract drawings. Logs of the explorations are also appended to these specifications.
- B. Said subsurface investigations are not warranted to show the actual subsurface conditions except at the location of said test pits or investigations, and at these points are subject to inaccuracies inherent in methods used and to variations in the classification and interpretation of soil layers.
- C. Subsurface information is included only as an aid to the Bidder and it is the obligation of the Bidder to draw his own conclusions of subsurface conditions from his own investigations prior to submitting his proposal. The Contractor agrees, in signing his Contract, that he will make no claims against the Owner or Engineer, if in carrying out the work, he finds that the actual conditions encountered in performing the work do not conform to conditions presented, discussed, or anticipated prior to the commencement of work, the Contractor shall notify the Owner immediately of such differences in the conditions.

**PART 3 - EXECUTION**

**3.1 REPORT REVIEW**

- A. A copy of the geotechnical engineering services report is appended to the project manual and shall be considered part of the Contract Documents.

**END OF SECTION**

**GEOTECHNICAL REPORT  
PREPARED BY  
SUMMIT GEOENGINEERING SERVICES**

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**SECTION 02 41 19**

**SELECTIVE DEMOLITION**

**PART 1 - GENERAL**

**1.1 SUMMARY**

- A. Section Includes:
  - 1. Demolition and removal of selected portions of building or structure.
  - 2. Demolition and removal of selected site elements.
  - 3. Salvage of existing items to be reused or recycled.
  - 4. Removal of selected site improvements (ex. Garage).

**1.2 DEFINITIONS**

- A. Remove: Detach items from existing construction and legally dispose of them off-site unless indicated to be removed and salvaged or removed and reinstalled.
- B. Remove and Salvage: Carefully detach from existing construction, in a manner to prevent damage, and deliver to Owner.
- C. Remove and Reinstall: Detach items from existing construction, prepare for reuse, and reinstall where indicated.
- D. Existing to Remain: Existing items of construction that are not to be permanently removed and that are not otherwise indicated to be removed, removed and salvaged, or removed and re-installed.

**1.3 PREINSTALLATION MEETINGS**

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

**1.4 INFORMATIONAL SUBMITTALS**

- A. Predemolition Photographs or Video: Submit before Work begins.

**1.5 CLOSEOUT SUBMITTALS**

- A. Landfill Records: Indicate receipt and acceptance of hazardous wastes by a landfill facility licensed to accept hazardous wastes.

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### 1.6 FIELD CONDITIONS

- A. Owner will not occupy portions of building immediately adjacent to selective demolition area.
- B. Conditions existing at time of inspection for bidding purpose will be maintained by Owner as far as practical.
- C. Notify Architect of discrepancies between existing conditions and Drawings before proceeding with selective demolition.
- D. Hazardous Materials: It is not expected that hazardous materials will be encountered in the Work.
  - 1. If suspected hazardous materials are encountered, do not disturb; immediately notify Architect and Owner. Hazardous materials will be removed by Owner under a separate contract.
- E. Storage or sale of removed items or materials on-site is not permitted.
- F. Utility Service: Maintain existing utilities indicated to remain in service and protect them against damage during selective demolition operations.
  - 1. Maintain fire-protection facilities in service during selective demolition operations (existing building does not have a sprinkler system).

### 1.7 WARRANTY

- A. Existing Warranties: Remove, replace, patch, and repair materials and surfaces cut or damaged during selective demolition, by methods and with materials so as not to void existing warranties.

## **PART 2 - PRODUCTS**

### 2.1 PERFORMANCE REQUIREMENTS

- A. Regulatory Requirements: Comply with governing EPA notification regulations before beginning selective demolition. Comply with hauling and disposal regulations of authorities having jurisdiction.
- B. Standards: Comply with ANSI/ASSE A10.6 and NFPA 241.

## **PART 3 - EXECUTION**

### 3.1 EXAMINATION

- A. Verify that utilities have been disconnected and capped before starting selective demolition operations.

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- B. Survey existing conditions and correlate with requirements indicated to determine extent of selective demolition required.
- C. When unanticipated mechanical, electrical, or structural elements that conflict with intended function or design are encountered, investigate and measure the nature and extent of conflict. Promptly submit a written report to Architect.
- D. Perform an engineering survey of condition of building to determine whether removing any element might result in structural deficiency or unplanned collapse of any portion of structure or adjacent structures during selective building demolition operations.
- E. Survey of Existing Conditions: Record existing conditions by use of preconstruction photographs.

### 3.2 UTILITY SERVICES AND MECHANICAL/ELECTRICAL SYSTEMS

- A. Existing Services/Systems to Remain: Maintain services/systems indicated to remain and protect them against damage.
- B. Existing Services/Systems to Be Removed, Relocated, or Abandoned: Locate, identify, disconnect, and seal or cap off indicated utility services and mechanical/electrical systems serving areas to be selectively demolished.
  - 1. Owner will arrange to shut off indicated services/systems when requested by Contractor.
  - 2. Arrange to shut off indicated utilities with utility companies.
  - 3. If services/systems are required to be removed, relocated, or abandoned, provide temporary services/systems that bypass area of selective demolition and that maintain continuity of services/systems to other parts of building.
  - 4. Disconnect, demolish, and remove irrigation systems, drainage piping, electrical systems, equipment, and components indicated to be removed.
    - a. Piping to Be Removed: Remove portion of piping indicated to be removed and cap or plug remaining piping with same or compatible piping material.
    - b. Piping to Be Abandoned in Place: Drain piping and cap or plug piping with same or compatible piping material.
    - c. Equipment to Be Removed: Disconnect and cap services and remove equipment.
    - d. Equipment to Be Removed and Reinstalled: Disconnect and cap services and remove, clean, and store equipment; when appropriate, reinstall, reconnect, and make equipment operational.
    - e. Equipment to Be Removed and Salvaged: Disconnect and cap services and remove equipment and deliver to Owner.

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### 3.3 PREPARATION

- A. Site Access and Temporary Controls: Conduct selective demolition and debris-removal operations to ensure minimum interference with roads, streets, walks, walkways, and other adjacent occupied and used facilities.
- B. Temporary Facilities: Provide temporary barricades and other protection required to prevent injury to people and damage to adjacent buildings and facilities to remain. Provide secure fencing to prevent unauthorized access to construction areas.
- C. Temporary Shoring: Provide and maintain shoring, bracing, and structural supports as required to preserve stability and prevent movement, settlement, or collapse of construction and finishes to remain, and to prevent unexpected or uncontrolled movement or collapse of construction being demolished.

### 3.4 SELECTIVE DEMOLITION, GENERAL

- A. General: Demolish and remove existing construction only to the extent required by new construction and as indicated. Use methods required to complete the Work within limitations of governing regulations and as follows:
  - 1. Neatly cut openings and holes plumb, square, and true to dimensions required. Use cutting methods least likely to damage construction to remain or adjoining construction. Use hand tools or small power tools designed for sawing or grinding, not hammering and chopping, to minimize disturbance of adjacent surfaces. Temporarily cover openings to remain.
  - 2. Cut or drill from the exposed or finished side into concealed surfaces to avoid marring existing finished surfaces.
  - 3. Do not use cutting torches until work area is cleared of flammable materials. At concealed spaces, such as duct and pipe interiors, verify condition and contents of hidden space before starting flame-cutting operations. Maintain fire watch and portable fire-suppression devices during flame-cutting operations.
  - 4. Locate selective demolition equipment and remove debris and materials so as not to impose excessive loads on supporting walls, floors, or framing.
  - 5. Dispose of demolished items and materials promptly. Comply with requirements in Section 01 74 19 "Construction Waste Management and Disposal."
- B. Removed and Salvaged Items:
  - 1. Clean salvaged items.
  - 2. Pack or crate items after cleaning. Identify contents of containers.
  - 3. Store items in a secure area until delivery to Owner.
  - 4. Transport items to Owner's storage area designated by Owner.
  - 5. Protect items from damage during transport and storage.
- C. Removed and Reinstalled Items:
  - 1. Clean and repair items to functional condition adequate for intended reuse.

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2. Pack or crate items after cleaning and repairing. Identify contents of containers.
  3. Protect items from damage during transport and storage.
  4. Reinstall items in locations indicated. Comply with installation requirements for new materials and equipment. Provide connections, supports, and miscellaneous materials necessary to make item functional for use indicated.
- D. Existing Items to Remain: Protect construction indicated to remain against damage and soiling during selective demolition. When permitted by Architect, items may be removed to a suitable, protected storage location during selective demolition and reinstalled in their original locations after selective demolition operations are complete.

### 3.5 DISPOSAL OF DEMOLISHED MATERIALS

- A. General: Except for items or materials indicated to be recycled, reused, salvaged, reinstalled, or otherwise indicated to remain Owner's property, remove demolished materials from Project site and legally dispose of them in an EPA-approved landfill and in accordance with Maine Department of Environmental Protection regulations.
1. Do not allow demolished materials to accumulate on-site.
  2. Remove and transport debris in a manner that will prevent spillage on adjacent surfaces and areas.
  3. Comply with requirements specified in Section 01 74 19 "Construction Waste Management and Disposal."
- B. Burning: Do not burn demolished materials.
- C. Disposal: Transport demolished materials off Owner's property and legally dispose of them.

### 3.6 CLEANING

- A. Clean adjacent structures and improvements of dust, dirt, and debris caused by selective demolition operations. Return adjacent areas to condition existing before selective demolition operations began.

**END OF SECTION**

SECTION 26 00 20

SITE ELECTRICAL & COMMUNICATIONS WORK

PART 1 – GENERAL

1.1 SECTION INCLUDES

- A. All work of this section shall be completed by an electrical subcontractor to the site contractor except where the site contractor elects to perform the work. The site contractor is responsible for assuring that the bid price includes all work of this section.
- B. Description: Provide all necessary site electrical work in connection with the following:
  - 1. Provision of a new 3-phase primary underground electrical line from the new terminal utility pole to a new concrete pad for a service transformer.
    - a. Wiring by Central Maine Power (CMP).
    - b. Conduit, hand holes, and manholes by the Electrical Sub-Contractor of Site Work Contractor.
  - 4. Provision of a new concrete transformer pad for an electrical service.
    - a. Concrete transformer pad by the Site Contractor.
    - b. Service transformer by Central Maine Power.
  - 5. Provision of empty electrical conduit from the service transformer to the concrete splice box.
  - 6. Provision of a post-mounted, utility service meter located adjacent to the service transformer.
    - a. Meter by Central Maine Power.
    - b. Meter post, conduit, and meter back box by the Electrical Sub-Contractor.
  - 7. Provision of service grounding at the concrete transformer vault for the CMP service transformer.
  - 8. Provision of relocated light poles.
    - a. Secondary underground electric to connect light poles.
  - 9. Provision of an empty telephone conduit from the terminal utility pole to a point one foot inside the proposed building.
    - a. Conduit by the Electrical Sub-Contractor for Site Work Contractor.
    - b. Telephone service cable by Fairpoint Communications (to be provided under separate contract for the proposed building), conduit by Site Work Contractor.

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11. Provision of an empty telecommunications conduit from the terminal utility pole to a point one foot inside of the proposed building.
    - a. Conduit by the Electrical Sub-Contractor of Site Work Contractor.
    - b. Cable TV service cable by telecommunications provider (to be provided under separate contract for the proposed building), conduit by Site Work Contractor.
  12. Provision of site lighting poles with luminaries, lamps, and anchor bolts.
    - a. Concrete foundation bases by the Site Contractor using anchor bolts provided by the pole supplier.
    - b. Poles, luminaries, lamps, anchor bolts to be reused.
    - c. Underground conduit and wiring by electrical subcontractor.
  13. Provision of empty underground conduit with pull string from site lighting junction box to be extended through the foundation wall of the proposed building perimeter.
    - a. Conduit by the Electrical Sub-Contractor for Site Work Contractor.
    - b. Wiring to be provided under separate contract for the proposed building.
- C. The Contractor for this work is referred to in Bidding Requirements, General Conditions, Special Conditions, Temporary Services and other pertinent Sections of these Specifications. These sections describe work that is a part of this Contract as contained in Division 1. The following General Provisions amplify and supplement these sections of Specifications. In cases of conflicting requirements, the stipulations set forth in Division 1 supersede and must be satisfied by the Contractor.

### 1.2 REFERENCES

- A. NEMA TC-2 – Electrical Plastic Tubing (EPT) and Conduit (EPC-40 and EPC-80).
- B. NEMA TC-3 – PVC Fittings for Use with Rigid PVC Conduit and Tubing.
- C. ANSI/NFPA 70 – National Electrical Code.
- D. ANSI C80.1 – Rigid Galvanized Steel Conduit.

### 1.3 SUBMITTALS

- A. Submit under provisions of Division 1.
- B. Product Data: Provide for each product specified herein. Indicate overall equipment dimensions and electrical characteristics including voltage, frame and trip ratings and short circuit withstand ratings where applicable.

### 1.4 PROJECT RECORD DOCUMENTS

- A. Submit under provisions of Division 1.
- B. Record the installed location of all electrical equipment and underground services.

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### **1.5 REGULATORY REQUIREMENTS**

- A. Complete installation shall conform with all applicable Federal, State and Local laws, Codes and Ordinances, included but not limited to latest approved editions of the following:
  - 1. National Electrical Safety Code (ANSI C2).
  - 2. National Electrical Code (NFPA 70).
  - 3. Occupational Safety and Health Act (OSHA) of 1971 and all amendments thereto.
  - 4. All applicable State and Local Codes.
- B. Nothing contained in the drawings and specifications shall be construed to conflict with these laws, codes, and ordinances, and they are thereby included in these specifications.
- C. Contractor shall visit the site to become familiar with all existing conditions affecting this work. No claim will be recognized for extra compensation due to failure of contractor to familiarize himself/herself with the conditions and extent of proposed work.
- D. Furnish products listed and classified by Underwriters Laboratories, Inc.
- E. Obtain permits and request inspections from all authorities having jurisdiction.

### **1.6 PROJECT CONDITIONS**

- A. Verify field measurements are as shown on Drawings.
- B. It is recognized that minor adjustments to locations may be required to coordinate with existing site conditions and underground utilities. Where equipment and/or conduit cannot be installed at the location shown on the plans, notify the Engineer to receive direction. Prior to installation of any site light pole or foundation, verify the minimum clearance requirements will be met with other overhead utilities, as required by utility company or other regulatory codes.

## **PART 2 – PRODUCTS**

### **2.1 CONDUIT AND FITTINGS**

- A. PVC Schedule 40 Plastic Conduit: NEMA TC 2.
- B. Plastic Conduit Fittings: NEMA TC-3.
- C. Rigid Galvanized Steel Conduit: ANSI C80.1.

### **2.2 UNDERGROUND WARNING TAPE**

- A. Underground Warning Tape: 6" wide plastic tape, colored red with suitable legend describing buried electrical lines: Model UT27737-6 as manufactured by Emedco, or equal.



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### **2.3 SITE LIGHTING**

- A. Provide site lighting poles/luminaries as described on the site lighting plans contained in the contract documents.
- B. Provide all necessary pole hardware including anchor bolts as required.
- C. Foundations, poles and anchor bolts shall be rated for the given EPA to withstand 90 mph wind with a 1.3 gust factor.
- D. Site lighting poles shall be provided with all necessary internal wiring conductors.
- E. Provide all site lighting poles with internal ground lugs.

## **PART 3 – EXECUTION**

### **3.1 EXISTING UNDERGROUND UTILITIES IDENTIFICATION**

- A. The Contractor shall utilize the services of Dig-Safe to identify locations of existing underground utilities within the vicinity of all new excavation work.

### **3.2 CONDUIT INSTALLATION**

- A. Cut conduit square using a saw or pipe cutter; de-burr cut ends.
- B. Bring conduit to the shoulder of fittings and couplings and fasten securely.
- C. Install no more than the equivalent of three 90-degree bends between poles.
- D. Avoid moisture traps where possible; where unavoidable, provide junction box with drain fitting at conduit low point.
- E. Use suitable conduit caps to protect installed conduit against entrance of dirt and moisture.
- F. Install electrical warning tape for all underground conduits 6 inches below the finished grade.
- G. Cap empty conduits for future use by others. Mark locations where ends of conduits are buried.

### **3.3 CONDUIT INSTALLATION SCHEDULE**

- A. Underground Locations - PVC, Schedule 40.
- B. Above ground Locations - Rigid galvanized steel conduit.

**END OF SECTION**

SECTION 31 10 00

SITE CLEARING

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes the following:
  - 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 site utilities.
  - 7. Temporary erosion and sedimentation control measures.

1.2 MATERIAL OWNERSHIP

- A. Except for stripped topsoil or 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.

1.3 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 authorities having jurisdiction.
- B. Salvable Improvements: Carefully remove items indicated to be salvaged and store on Owner's premises. Coordinate storage locations with Owner.
- C. Utility Locator Service: Notify utility locator service for area where Project is located before site clearing. Note that a private utility detection service will be required to identify utilities on the school property. The Contractor shall be responsible for the cost of private utility detection.
- D. Do not commence site clearing operations until temporary erosion and sedimentation control and plant protection measures are in place.

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- 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. See Soil Management Plan for specific requirements related to imported soils on the site.

### PART 2 - PRODUCTS

#### 2.1 MATERIALS

- A. Satisfactory Soil Material: Requirements for satisfactory soil material are specified in Section 31 20 00 "Earth Moving".
  - 1. Obtain approved borrow soil material off-site when satisfactory soil material is not available on-site.

### PART 3 - EXECUTION

#### 3.1 PREPARATION

- A. Protect and maintain benchmarks and survey control points from disturbance during construction.
- B. Locate and clearly flag trees and vegetation to remain or to be relocated.
- 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 for the project.
- B. Verify that flows of water redirected from construction areas or generated by construction activity do not enter or cross protection zones.

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- C. Inspect, repair, and maintain 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 PROTECTION

- A. General: Protect trees and plants remaining on-site according to requirements in Section 01 56 39 "Temporary Tree and Plant Protection".
- B. Repair or replace trees, shrubs, and other vegetation indicated to remain or be relocated that are damaged by construction operations, in a manner approved by Owner's Rep and Engineer.

### 3.4 EXISTING UTILITIES

- A. 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.
- B. 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 Owner's Rep and Engineer not less than two days in advance of proposed utility interruptions.
  - 2. Do not proceed with utility interruptions without Owner's Rep and Engineer's written permission.
- C. Removal of underground utilities is included in earthwork sections and with applicable fire suppression, plumbing, HVAC, electrical, communications, electronic safety and security and utilities sections and Section 02 41 19 "Selective Demolition".

### 3.5 CLEARING AND GRUBBING

- A. Clearing and grubbing shall include the removal of all trees, shrubs, vegetation, roots, and organic measures to permit installation of new construction. The Contractor may elect to remove some of the roots during loam stripping operations. Any area that will be regraded must be cleared and grubbed.
- 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.

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### **3.6 TOPSOIL STRIPPING**

- A. Remove sod and grass before stripping topsoil. All removals/excavation shall be completed in accordance with the Soil Management Plan.
- B. Strip topsoil to depth of 6 inches in a manner to prevent intermingling with underlying subsoil or other waste materials.
- C. Stockpile topsoil materials 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.

### **3.7 SITE IMPROVEMENTS**

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

### **3.8 DISPOSAL OF SURPLUS AND WASTE MATERIALS**

- A. Disposal: Remove unsuitable topsoil, obstructions, demolished materials, and waste materials including trash and debris, stumps and cleared material, and legally dispose of them off Owner's property.
  - 1. Separate recyclable materials produced during site clearing from other nonrecyclable materials. Store or stockpile without intermixing with other materials and transport them to recycling facilities.
  - 2. All topsoil shall be screened. Excess topsoil, if any, shall remain the property of the Owner. The location for stockpile material shall be agreed upon with the Owner.

**END OF SECTION**

SECTION 31 20 00

EARTH MOVING

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes the following:

1. Preparing subgrades for slabs-on-grade, walks, pavements, play surfaces, and all other subgrade surfaces required for this project.
2. Excavating and backfilling for site improvements and structures.
3. Moisture condition and/or chemically treat excavated soils as necessary to provide workable fill material that will meet the compaction specifications and maximize reuse of existing soils.
4. Subbase course for walks and pavements.
5. Subbase and base course for asphalt paving.
6. Excavating and backfilling for utility trenches.

B. Related Requirements

1. See Section 02 32 00 Geotechnical Investigation
2. See Section 31 10 00 Site Clearing
3. See Section 32 13 16.26 Rock Removal
4. See Soil Management Plan

1.2 DEFINITIONS

A. Backfill: Soil 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: Course placed between the subbase course and hot-mix asphalt paving.

C. Bedding Course: Course placed over the excavated subgrade in a trench before laying pipe.

D. Borrow Soil: Satisfactory soil imported from on or off-site for use as fill or backfill.

E. Drainage Course: Course supporting the slab-on-grade in areas where underslab drainage is required that also minimizes upward capillary flow of pore water.

F. Excavation: Removal of material encountered above subgrade elevations and to lines and dimensions indicated.

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1. Authorized Additional Excavation: Excavation below subgrade elevations or beyond indicated lines and dimensions as directed by Engineer. Authorized additional excavation and replacement material will be paid for according to Contract provisions changes in the Work.
2. Unauthorized Excavation: Excavation below subgrade elevations or beyond indicated lines and dimensions without direction by Engineer. Unauthorized excavation, as well as remedial work directed by Engineer, shall be without additional compensation.

- G. Fill: Soil materials used to raise existing grades.
- H. Structures: Buildings, footings, foundations, retaining walls, slabs, curbs, electrical appurtenances, or other man-made stationary features constructed above or below the ground surface.
- I. Subbase Course: Course placed between the subgrade and base course for hot-mix asphalt pavement, or material placed between the subgrade and a cement concrete pavement or a cement concrete or hot-mix asphalt walk.
- J. Subgrade: Surface or elevation remaining after completing excavation, or top surface of a fill or backfill immediately below subbase, drainage fill, or topsoil materials.
- K. Utilities: On-site underground pipes, conduits, ducts, and cables, as well as underground services within buildings.
- L. Zone of Influence (ZOI): The area below footings and below imaginary lines that extend 2 ft laterally beyond the footing outer bottom edges and down on a 1H:1V slope to suitable bearing material.
- M. Pipe Zone: The pipe zone is considered to be the area from the invert of the pipe to 6 inches above the crown of the pipe.
- N. Pipe Bedding: Pipe bedding is the material placed between the bottom of the trench and the invert of the pipe.

### 1.3 PROJECT CONDITIONS

- A. Existing Utilities: Do not interrupt utilities serving facilities occupied by Owner or others unless permitted in writing by Engineer and then only after arranging to provide temporary utility services according to requirements indicated. A private utility detection service will be required to identify utilities within the school property.

### 1.4 SUBMITTALS

- A. General
1. Unless otherwise noted, Contractor shall forward submittals to the Engineer a minimum of two weeks prior to any planned work related to the Contractor's submittals.
  2. The time period(s) for submittals are the minimum required by the Engineer to review, comment and respond to the Contractor. The Engineer may require resubmission(s) for various reasons. The Contractor is responsible for scheduling specified submittals and resubmittals so as to prevent delays in the work.

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3. The Contractor's submittals shall be reviewed and accepted by the Engineer prior to conducting any work.
  4. Acceptance of the Contractor's submittals by the Engineer does not relieve the Contractor of responsibility for the adequacy, safety and performance of the work.
- B. Excavation and Backfilling
1. A narrative describing the schedule and means and methods for placement/compaction of fill soils based on the material requirements provided in Part 2 of this Section.
  2. Proposed type(s) and source(s) of chemicals to treat borrow soils to be reused beneath building or pavement areas if site work activities are to be performed outside of summer months.
  3. A plan showing delineated site "haul roads" for heavy construction equipment such as articulated trucks and scrapers.

## PART 2 - PRODUCTS

### 2.1 SOIL MATERIALS

- A. General: Provide borrow soil materials when sufficient satisfactory soil materials are not available from excavations. In general, the Owner's intent is to encourage the use of onsite excavated materials for subgrade fills subject to the material requirements provided herein.
- B. Satisfactory Soils: The existing soils will not meet the gradation specifications for Structural Fill, Base Course or Subbase Material. The native soils are acceptable for common subgrade fill if moisture conditioned and placed to meet the density and other requirements of the Contract Documents. The native soil may require segregation by type, blending with offsite borrow, filling with choke stone, must be free of organics, and moisture conditioned during winter construction or wet weather or extreme dry conditions. In no case should frozen soils be used beneath the building footprint, parking areas, or driveways.
- C. Unsatisfactory Soils: Soil Classification Groups GC, SC, CL, OL, CH, MH, OH, and PT or a combination of these groups and satisfactory soils not maintained within 2 percent of optimum moisture content at time of compaction.
- D. Subbase Course: Maine DOT 703.06 Type D. (Maximum Particle Size of 4 inches)
- E. Base Course: Maine DOT 703.06 Type A. (Maximum Particle size of 2 inches)
- F. Granular Borrow: Maine DOT 703.19 with a maximum particle size of 6 inches. Note that existing subgrade soils may meet the definition of Granular Borrow and may be used in place of imported materials if the Contractor can provide third party testing confirming conformance with this specification.
- G. Crushed Stone: Maine DOT 703.22 Backfill for Underdrain Type C.
- H. Pipe Bedding: Maine DOT 703.22 Backfill for Underdrain Type C.
- I. Foundation Backfill: Foundations shall be backfilled with foundation backfill. The portion of foundation backfill passing the 3" sieve size should meet the following gradation requirements:



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FOUNDATION BACKFILL	
Sieve Size	Percent Passing By Weight
3-inch	100
¼-inch	25 to 100
No. 40	0 to 50
No. 200	0 to 7

\*The maximum particle size should be limited to 3-inches.

- J. Structural Fill: Structural fill shall be used as fill below ground floor slabs. Structural fill shall be a well graded sand and gravel mixture free of roots, topsoil, loam, organic material, and any other deleterious materials, as well as clods of silt or clay, and meet the following gradation requirements:

STRUCTURAL FILL	
Sieve Size	Percent Passing By Weight
3-inch	100
½-inch	38 to 80
¼-inch	25 to 65
No. 40	0 to 30
No. 200	0 to 7

\*The maximum particle size should be limited to 3-inches.

### 2.2 ACCESSORIES

- A. Warning Tape: Acid- and alkali-resistant polyethylene film warning tape manufactured for marking and identifying underground utilities, 6 inches wide and 4 mils thick, continuously inscribed with a description of the utility with a separate metallic “tracer”. This is required for all non-metallic utility lines except “straight runs” of sewer lines and storm drains between manholes.

## PART 3 - EXECUTION

### 3.1 PREPARATION

- A. The earthwork shall be conducted in accordance with the more stringent of the Maine DOT Specifications, and these specifications. All cost for moisture conditioning and complying with the Contract Documents is part of the base bid.
- B. Protect structures, utilities, sidewalks, pavements, and other facilities from damage caused by settlement, lateral movement, undermining, washout, and other hazards created by earthwork operations.
- C. Designated haul roads shall be established by the Contractor at the beginning of earthwork operations to minimize damage to soil subgrades resulting from construction vehicle traffic. The use of geotextile fabric and/or geogrid to stabilize haul road subgrades shall be included by the Contractor as part of the base bid.

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- D. Preparation of subgrade for earthwork operations including removal of vegetation, topsoil, debris, obstructions, and deleterious materials from ground surface is specified in Division 31 Section "Site Clearing."
- E. Protect and maintain erosion and sedimentation controls, which are specified in Division 31 Section "Site Clearing." during earthwork operations.
- F. Due to the previously developed nature of the site, the Project Contractor and their Subcontractors should be sensitive to the potential of encountering obstructions such as remnants from prior structures and buildings, associated foundations, and underground utilities (note: both active and abandoned) during site and earthwork activities. It is anticipated that obstructions may include, but not limited to, conduits, electrical and communications lines, and irrigation piping. Where such items are encountered beneath the proposed construction limits, they should be excavated to their full extent, removed, and replaced with compacted structural fill. The ends of underground pipes and utility conduits that will be abandoned in-place should be filled with concrete and capped to prevent erosion of material into the conduit or pipe.

### 3.2 EXCAVATION FOR STRUCTURES

- A. Excavate to indicated elevations and dimensions within a tolerance of plus or minus 1 inch. If applicable, extend excavations a sufficient distance from structures for placing and removing concrete formwork, for installing services and other construction, and for inspections.
- B. Remove all organic soils within the ZOI of footings or slabs to expose naturally deposited soils or bedrock.
- C. Excavation of bearing surfaces in soil or fill should be performed by earthwork equipment fitted with smooth-edged buckets. Final subgrade preparation should include compaction of fill or naturally deposited soil subgrades with vibratory compaction equipment. Following compaction and prior to placement of imported materials, care should be taken to limit disturbance of the bearing surfaces. Any loose, softened, or disturbed material due to construction traffic should be removed prior to placement of imported materials, and backfilled with compacted structural fill.
- D. The integrity of natural soils and fill must be maintained during cold weather conditions. Footing and slab subgrades should not be allowed to freeze. The naturally deposited soils are considered moderately. Freezing of subgrade soils beneath improvements might result in heaving and post-construction settlement. The Contractor should make every effort to prevent freezing of subgrade soils. In the event frost penetration occurs, all frozen and previously frozen soils should be removed and replaced with compacted structural fill. At no time should frozen material be placed as fill.
- E. Excavation measurement and pay dimensions shall extend 12" beyond the footing or slab.

### 3.3 EXCAVATION FOR WALKS AND PAVEMENTS

- A. Excavate surfaces under walks and pavements to indicated lines, cross sections, elevations, and subgrades.
- B. Remove all man placed fill, topsoil, organic matter, and debris encountered within the footprint of site improvements and structures.

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- C. Proof-rolling should be performed using a fully loaded, tandem axle dump truck weighing not less than 25 tons or 2 passes in each of two perpendicular directions with a 5 ton min. vibratory roller. Proof-rolling should not be performed over culverts, pipes, conduits, or other underground construction that might be damaged by the proof-roller. Soft areas or areas that yield excessively during proof-rolling should be over excavated and replaced with  $\frac{3}{4}$ " crushed stone or structural fill. Soft areas or areas that yield excessively are characterized by weaving or rutting more than one inch deep.

### 3.4 EXCAVATION FOR UTILITY TRENCHES

- A. Excavate trenches to indicated gradients, lines, depths, and elevations.
- B. Excavate trenches to uniform widths to provide the following trench width. Excavate trench walls vertically from trench bottom to 12 inches higher than top of pipe or conduit, unless otherwise indicated.
- C. A minimum and pay width of 2'-6" for conduits up to 6" diameter.
- D. A minimum of 3'-0" or  $\frac{4}{3}$  the pipe inside diameter plus 1'-6" for conduits over 18".
- E. 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.
- F. Excavate trenches 6 inches deeper than elevation required in rock or other unyielding bearing material, 4 inches deeper elsewhere, to allow for bedding course.

### 3.5 SUBGRADE INSPECTION

- A. Proof-roll subgrade consisting of granular soils (engineered fill or glacial till) below slabs and under pavement as outlined in paragraph 3.3.C above. Any soft pockets, areas of excess yielding, or areas disturbed during excavation and construction shall be over excavated and replaced with structural fill. Do not proof-roll wet or saturated subgrades or subgrades consisting of silt/clay soils (marine deposits).
- B. The exposed subgrade will be examined in the field by the Engineer to observe the strength and bearing capacity of the soils. Disturbed or soft soils, as judged by the Engineer, shall be excavated and replaced with suitable material without additional compensation.
- C. Reconstruct subgrades damaged by freezing temperatures, frost, rain, or accumulated water, as directed by Engineer, without additional compensation.
- D. Overexcavate subgrades disturbed/damaged by construction vehicle traffic to the depth and plan limits directed by the Engineer. Replace disturbed soil with suitable material without additional compensation.

### 3.6 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 Engineer.
- B. Fill unauthorized excavations under other construction or utility pipe as directed by Engineer.

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### 3.7 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 and erosion.
- B. Stockpile soil materials away from edge of excavations. Do not store within drip line of remaining trees.
- C. Stockpiles must be contained within permissible work and staging areas in accordance with the detail shown on the Drawings.

### 3.8 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. Backfill trenches with Engineered Fill, Gravel Borrow, or granular backfill, or crushed stone.
- D. Provide 4-inch thick, concrete-base slab support for piping or conduit less than 30 inches below surface of roadways. After installing and testing, completely encase piping or conduit in a minimum of 4 inches of concrete before backfilling or placing roadway subbase.
- E. Place and compact pipe zone backfill to a height of 6 inches over the utility pipe or conduit.
- F. Carefully compact pipe zone backfill under pipe haunches and compact evenly up on both sides and along the full length of utility piping or conduit to avoid damage or displacement of piping or conduit. Coordinate backfilling with utilities testing.
- G. Place and compact trench granular backfill of satisfactory soil to final subgrade elevation.
- H. Install warning tape directly above utilities as noted in Section 2.2, 12 inches below finished grade, except 6 inches below subgrade under pavements and slabs.

### 3.9 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.
  - 1. Place and compact fill material in layers to required elevations as follows:
  - 2. Under grass and planted areas, use satisfactory soil material.
  - 3. Under walks and pavements, use Granular Fill below base and subbase gravels.
- B. In open areas, structural fill should be placed in level, uniform lifts not exceeding 12 inches in uncompacted thickness and be compacted with self-propelled compaction equipment. In confined areas and within 4 feet of foundation walls, structural fill should be placed in lifts not exceeding 6 inches in uncompacted thickness and be compacted with hand-operated compaction equipment. All fill placed for footing and slab support should be structural fill compacted to at least 95 percent of the maximum dry density as determined by *ASTM Standard D1557 Test Method for Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 ft-lbf/ft<sup>3</sup> (2,700 kN-m/m<sup>3</sup>))*.

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### 3.10 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, aerate or chemically treat otherwise satisfactory soil material that exceeds optimum moisture content by 2 percent and is too wet to compact to specified dry unit weight.

### 3.11 COMPACTION OF SOIL BACKFILLS AND FILLS

- A. Granular Borrow and Common Fill: Place in layers not more than 6 to 12 inches in loose depth for material compacted by heavy compaction equipment and not more than 6 inches for material compacted with hand-guided equipment.
- 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 1557:

Location	Minimum Compaction Requirements	Testing Frequency 1 Lift per:
Structures and Walkways	95 Percent	5,000 square feet
Trenches	95 Percent Bedding and 92 Percent Trench Zone	100 linear feet
Pavement Base and Subbase Areas	95 Percent	5,000 square feet
Pavement Areas (Below Base & Subbase)	92 Percent	5,000 square feet
Landscaped Areas	90 Percent Nominal Compaction	5,000 square feet

### 3.12 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.
- B. Site Grading: Slope grades to direct water away from buildings and to prevent ponding. Finish subgrades to required elevations within the following tolerances:
  - 1. Lawn or Unpaved Areas: Plus or minus 1 inch.
  - 2. Walks: Plus or minus ¼" with no "bird baths".
  - 3. Pavements: Plus or minus ¼" with no "bird baths".

### 3.13 SUBBASE AND BASE COURSES

- A. Place subbase and base course on stable, firm subgrades free of mud, frost, snow, or ice.
- B. On prepared subgrade, place subbase and base course under pavements and walks as follows:
  - 1. Shape subbase and base course to required crown elevations and cross-slope grades.

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- C. Compact subbase and base course in maximum 8 inch lifts in uncompacted thickness at optimum moisture content to required grades, lines, cross sections, and thickness to not less than 95 percent of maximum dry unit weight according to ASTM D 1557.

### 3.14 DRAINAGE COURSE

- A. Place drainage course on stable, firm subgrades free of mud, frost, snow, or ice.
- B. On prepared subgrade or filter fabric as shown on the Drawings, place and compact drainage course under cast-in-place concrete slabs-on-grade as follows:
  - 1. Place drainage course that exceeds 6 inches in compacted thickness in layers of equal thickness, with no compacted layer more than 6 inches thick or less than 3 inches thick.
- C. 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.

### 3.15 FIELD QUALITY CONTROL

- A. Testing Agency: Owner will engage a qualified independent geotechnical engineering testing agency to perform field quality control testing.
- B. Allow testing agency to inspect and test subgrades and each fill or backfill layer. Proceed with subsequent earthwork only after test results for previously completed work comply with requirements.
- C. Footing Subgrade: At footing subgrades consisting of engineered fill materials, tests will be performed to verify that the compaction requirements are achieved. Bearing capacities will be verified visually in natural soils (glacial till), weathered rock or bedrock.
- D. 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.

### 3.16 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 without additional compensation.
- C. Where settling occurs before Project correction period elapses, remove finished surfacing, backfill with additional soil material, compact, and reconstruct surfacing.
- D. Restore appearance, quality, and condition of finished surfacing to match adjacent work, and eliminate evidence of restoration to greatest extent possible.

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- E. The in-situ sandy soils and gradation makes them susceptible to “loosening” if allowed to dry out. The contractor shall keep the soils moist and cover with a 12” layer of sand/soil mix approved to the geotechnical engineer of record.
- F. All areas where soil is placed shall not have standing water. The contractor shall keep water out of the work areas until backfill is complete or adequate provisions to protect the work have been taken by the Contractor.

### **3.17 DISPOSAL OF SURPLUS AND WASTE MATERIALS**

- A. Disposal: Remove surplus satisfactory soil except loam and materials otherwise shown on the contract drawings, waste material, including unsatisfactory soil, trash, and debris, and legally dispose of it off Owner's property.

**END OF SECTION**

SECTION 31 23 16.26

ROCK REMOVAL

PART 1 - GENERAL

1.1 SECTION INCLUDES

- A. Rock removal shall only be conducted by qualified contractors who have at least 15 years' experience in rock removal by blasting and have five recent projects and references for rock removal within 100 feet of existing buildings. The qualifications of the contractor who will conduct the rock removal shall be provided for review at the preconstruction conference.
- B. The Site Contractor and the contractor who will conduct the rock removal shall attend a public informational meeting to address questions and explain the techniques and methods which will be used for rock removal. This meeting shall occur at least 14 days prior to any rock removal in order that the Owner can obtain samples of well water of any interested abutter.
- C. The work to be done includes furnishing all labor, equipment, materials and services and performing operations required to fragment intact bedrock utilizing controlled blasting techniques to enable the excavation of blasted material using conventional excavation equipment. The work shall be completed such that damage is prevented to adjacent pipes, structures, property, utilities, and operations.
- D. Pre-blast Surveys, Public Meetings, and Quality Control.
- E. Removal of identified and discovered rock during excavation.
- F. Use of Explosives to assist rock removal.
- G. Incorporating removed rock into fills and embankments.
- H. Conducting blast monitoring of every blast round during construction and utilizing the blast monitoring procedures and equipment specified herein.
- I. Coordinate work with other trades affecting or affected by the work and cooperate with such trades to assure the steady progress of work.
- J. Obtaining all required permits and licenses to perform the blasting for this project. The Contractor shall be responsible for obtaining all applicable permits including, but not limited to, a City of Portland Blasting Permit.

1.2 RELATED SECTIONS

- A. Section 31 20 00 – Earth Moving.
- B. Geotechnical Report for test pit locations and findings of subsurface materials and conditions.



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- C. Construction Drawings.

### 1.3 REFERENCE STANDARDS

- A. NFPA 495 – Code for Explosive Materials

### 1.4 ENVIRONMENTAL REQUIREMENTS

- A. Determine all environmental effects associated with proposed work and safeguard those concerns as regulated by law and all others by reasonable and practiced methods.

- B. Perchlorates shall not be used as a blasting agent.**

- C. Coordinate blasting, monitoring, seismographs, and Owner radon testing.
- D. Test nearby potable wells prior to blasting.

### 1.5 SUBMITTALS

- A. Submit under provisions of Division 1.

- B. The Contractor shall submit the following information to the Owner and Engineer within seven (7) days prior to commencing drilling and blasting operations. Technical Submittals and blast designs shall be completed by experienced, competent Engineers familiar with controlled blasting.

1. Sequence and schedule of blasting rounds, including the general method developing the excavation, lift heights, etc.
2. Specifics of a typical blast round to be implemented in each of the following areas:
  - (a) test blast areas,
  - (b) the closest blasting area to adjacent structures,
  - (c) where perimeter control blasting is required and
  - (d) at the deepest rock cut areas.
3. In each area specified, include the following blast round details:
  - (a) Diameter, spacing, burden, depth and orientation of each blast hole for each round design.
  - (b) Nomenclature and amount (in terms of weight and number of cartridges) of explosive and distribution of charge to be used within each hole, on each delay and the total for the blast.

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- (c) Nomenclature and type of detonators, delay pattern wiring diagram for the round, type and capacity of firing source, size, type and location of safety switches and lightning gap.
  - (d) Type and location of stemming to be used in the holes.
  - (e) Calculations of anticipated vibration levels at nearest adjacent structure.
  - (f) Methods of matting or covering of the blast area in open excavations to prevent fly rock and excessive air-blast over-pressure.
  - (g) Written evidence of the licensing, experience and qualifications of the blasters who will be directly responsible for the loading and firing of each shot.
  - (h) Name and qualifications of the person(s) responsible for the design and directing the blasting.
  - (i) Name and qualifications of the independent professional responsible for conducting the pre-blast condition surveys.
  - (j) Name and qualifications of the independent professional or seismologist responsible for monitoring and reporting blast vibrations.
  - (k) Recent calibration certificates (within previous 6 months) for the proposed blast monitoring instrumentation.
  - (l) Listing of instrumentation that the contractor proposed to use to monitor vibrations and air-blast over-pressure levels complete with performance specifications and user's manual supplied by the manufacturer.
  - (m) Submit a Certificate of Insurance documenting that liability insurance coverage in an amount no less than \$2,000,000, or as otherwise required by the Owner, will be in force during the duration of the project.
  - (n) Pre-blast condition surveys for neighboring residential and commercial property. A written report of the pre-condition survey shall be provided to the property owners. Notification shall be given to the neighbors prior to the commencement of any blasting.
  - (o) The Contractor shall perform a pre-blast survey of nearby structures as specified in this specification. The survey will include, as a minimum, video with audio description of areas of exterior and interior building surfaces. One copy will be maintained by the Contractor and one copy shall be supplied to the Owner.
- C. In the event that the ground vibrations and/or air blast over-pressures exceed the blasting limit criteria in this Section, the Contractor shall immediately revise the design appropriately and submit the revised design to the Engineer for review.
- D. Review by the Engineer or Owner of the blast design and techniques shall not relieve the Contractor of responsibility for the accuracy, adequacy and safety of the blasting as well as the protection of existing structures and overall safety. Loose, over-hanging or unstable rock along permanent rock cuts shall be removed as necessary or as directed by the Engineer. Controlled blasting procedures shall be utilized in areas of permanent rock cuts to minimize over-breakage and fracturing.
- E. The material that will be used including MSDS Data Sheets.

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- F. Perchlorates are not permitted as a blasting agent.**
- G. Blasting agents used below the water table shall be canister type.**

1.6 QUALITY ASSURANCE

A. Qualifications

1. Persons responsible for blasting shall be licensed blasters in the State of Maine and shall have had experience in similar excavations in rock and controlled blasting techniques.
2. The contractor shall engage the services of a qualified, independent professional consultant, acceptable to the Engineer, to conduct a pre-blast condition survey of adjacent buildings, utilities and other concerned structures within 500 ft. of the blast or as required by Code.
3. Blast monitoring shall be conducted by a qualified professional engineer or seismologist trained in the use of seismographs. The name and experience of the seismologist shall be submitted to the Owner for review and approval. The seismologist shall also attend the public informational meeting. The blast records shall be maintained, analyzed and reported by persons familiar with the frequency content of a seismograph record.

B. Codes, Permits and Regulations

1. The contractor shall comply with all applicable laws, rules, ordinances and regulations of the Federal Government, the State of Maine, City of Portland, and the Owner, governing the transportation, storage, handling and use of explosives. All labor, material, equipment and services necessary to make a blasting operation comply with such requirements shall be provided without additional cost to the Owner.
2. The contractor shall obtain and pay for all permits and licenses required to complete the work of this Section.
3. In the case of a conflict between regulations or between regulations and Specifications, the Contractor shall comply with the strictest applicable codes, regulation or specification.

C. Blast Vibration Limits for Curing Concrete

1. Mass concrete on-grade which would not be subject to bending such as footings:

<u>Age of Concrete</u>	<u>Allowable (PPV)</u>
Less than 72 hours	1.0 inch/second
At least 72 hours	4.0 inch/second

2. Concrete which could potentially undergo bending such as walls, structural slabs, columns, and elevated slabs:

<u>Age of Concrete</u>	<u>Allowable (PPV)</u>
Less than 72 hours	0.5 inch/second

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At least 72 hours                      2.0 inch/second

3. Blasting shall not be permitted within 50 ft. of new concrete unless a blast plan for the specified blast is forwarded by the Contractor and approved by the Engineer.
  4. The contractor shall comply with the Blasting Limit Criteria during all blasting. Adjustments to the drilling and blasting program and procedures to comply with the Blasting Limit Criteria shall be made by the Contractor during the execution of the work at no additional expense to the Owner.
- D. Blast Monitoring
1. The Contractor shall monitor PPV and air-blast over-pressures resulting from each blast. Additional locations for blast monitoring may be necessary due to concerned structures within and around the blast.
- E. Blast Monitoring Reports
1. Following each blast, a Blast Monitoring Report shall be submitted to the Owner and Engineer within 24 hours.
  2. Any vibrations or air over-blast pressures close to or exceeding the specified limits shall be immediately reported to the Owner and Engineer.
- F. Blast Monitoring Instrumentation
1. All instrumentation proposed for use on the project shall have been calibrated within the previous six (6) months to a Standard which is traceable to the National Bureau of Standards. Characteristics of the required instrumentation are listed below.
  2. Measure the three (3) mutually perpendicular components of particle velocity in directions vertical, radial and perpendicular to the vibration source.
  3. Measure and display the maximum PPV component, the associated frequency, and the peak air-blast over-pressure. The readings must be displayed and be able to read in the field immediately after each blast.
  4. Furnish a permanent time history record on a strip chart (or from computer disk), of PPV components and air-blast over-pressure.
  5. The Contractor shall cooperate with the Engineer in permitting observation of the Contractor's drilling and loading procedures, as well as providing detailed information on blasting operations.
- G. The Contractor shall be completely responsible for all damages resulting from the blasting operations and shall, at a minimum, take whatever measures necessary to maintain PPV and peak air-blast over-pressure within specified or required limits. Modifications to the blasting

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and excavation methods required to meet these requirements shall be undertaken at no additional cost to the owner.

- H. Airborne Dust and Noise Limits: The Contractor shall take precautions, such as the use of water, vacuums, and mufflers to minimize noise and dust from the air track operations, and shall keep noise and airborne dust levels below regulatory limits.

### 1.7 PROJECT CONDITIONS

- A. **The Contractor shall be fully responsible for conducting any investigations necessary to determine the extent and quality of rock on the site prior to submitting his bid. Rock locations may vary from that inferred by the geotechnical report based upon the inherent limitations of this work.**

## PART 2 - PRODUCTS

### 2.1 MATERIALS

- A. Explosives, delay device and blast mat materials shall be the type recommended by the explosive firm that will comply with the requirements of this section.

## PART 3 - EXECUTION

### 3.1 SAFETY PRECAUTIONS

- A. Clearing the Danger Area Before Blasting: No blasting shall be permitted until all personnel in the danger area have been removed to a place of safety. A loud, audible warning system shall be sounded before each blast. The Contractor shall familiarize all personnel on the project, Engineer, Owner and the general public with the implemented system. The danger area shall be patrolled before each blast to make certain that it has been completely cleared prior to a blast.
- B. Explosives shall be stored, handled and employed in accordance with federal, state and local regulations.
- C. No explosives, caps, detonators or fuses shall be stored on the site during non-working hours.
- D. The Contractor shall be responsible for determining any other safety requirements unique to blasting operations so as not to endanger life, property, utility services, any existing or new construction, or any property adjacent to the site.
- E. Blasting mats or other cover shall be used for each blast to secure all fly rock.

### 3.2 GENERAL BLASTING PROCEDURES

- A. Blasting shall be limited to between the hours of 8:00 am and 4:00 pm, Monday through Friday, or as otherwise restricted by the Portland Fire Department and City Officials. No blasting shall

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be completed on weekends, holidays or other weekday times until written permission is received by the Owner.

- B. The Contractor shall notify the Owner and Engineer at least 48 hours before blasting operations are to commence.
- C. The Contractor shall conduct all blasting operations such that damage or disruption is prevented to adjacent structures, utilities, property and operations, and such that PPV and air-blast over-pressure levels do not exceed the maximum specified limits.
- D. The Contractor shall control dust so as to prevent dust from leaving the site boundaries.
- E. Designed blast rounds shall be utilized with adjacent relief to allow the rock to move out towards a free face.
- F. All overburden soils and loose rock shall be removed from areas where blasting is planned. The exposed bedrock surface shall be surveyed by a licensed land surveyor to determine the limits for payment unless the Contractor has agreed to a lump sum price for the work with no measurement for additional rock.
- G. In areas where blasting is required in the building footprint, a structural fill is required 8-inches below and laterally beyond the footing limits. Loose, heaved and/or highly fractured bedrock below this depth shall be completely removed to expose intact bedrock or a tight fragmented over-blast suitable to the Engineer. In order to ensure good bearing material for the footings, the Contractor shall conduct blasting such that over-break and fracturing of the rock is minimized below the required subgrade level. Sub-drilling (depth of blast hole below required subgrade) shall be kept to the minimum necessary to adequately fragment and remove the rock to the limits of excavation. The sub-drilling shall not exceed 2 ft. unless the Contractor has submitted in advance a written request indicating why additional sub-drilling is necessary for the project.
- H. Highly fractured, heaved and/or disturbed over-blast ledge beyond the payment limits shall be removed by the Contractor and replaced with compacted Structural Fill or  $\frac{3}{4}$  inch crushed stone at no additional cost to the Owner except in the foundation overblast area. Tight over blast ledge may remain in-place provided it is reviewed and acceptable to the Engineer.
- I. Permanent rock slope cuts no steeper than 1H:2V may be required for the project as shown on the Drawings. The Contractor shall use controlled blasting procedures by pre-splitting the rock prior to primary blasting. The permanent rock face shall be stable with no over-hanging or highly fractured rock. Particular attention, design, precautions and blasting operations shall be focused on these areas of the site.
- J. Retain this article only if it supplements Division 01 requirements and includes provisions that apply specifically to individual Sections for cleaning, repairing, protecting, or otherwise preparing substrates for installation.

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### 3.3 PREPARATION

- A. Verify site conditions and note subsurface conditions affecting work of this section. Coordinate Owner radon monitoring.
- B. Identify required lines, levels, and elevations that will determine the extent of the proposed removals.
- C. Conduct a pre-blast survey in accordance with the following requirements:
  1. The Contractor shall conduct a Pre-Blast Survey of all structures within the Blast Area and provide the Owner and the City of Portland, a written report of the Pre-Blast Survey and Blasting Plan. The Pre-Blast Survey shall be filed, reviewed, and approved by the City of Portland. This survey should include:
    - All structures within a minimum distance of 500 feet from any blasting activity. The area extending beyond the 500 feet minimum shall be determined by the Contractor. This distance shall be confirmed after consultation of the General Contractor, Site Contractor, Blasting Contractor and Insurance Companies.
    - A Blasting Plan which addresses:
      - Airblast limits
      - Ground vibrations
      - Maximum peak particle velocity
    - The Blasting Plan shall meet criteria established in Chapter 3 (Control of Adverse Effects) in the Blasting Guidance Manual of the United States Dept. of the Interior Office of Surface Mining Reclamation and Enforcement.
    - Provisions and measures to monitor and assure compliance with the blasting plan.
  2. The Contractor shall provide the Engineer with a Blasting Log for the work. The Blasting Log shall contain the following information:
    - Location
    - Time and Date
    - Number of Holes
    - Amount and type of explosive used per hole
    - The names of persons, companies, corporations, or public utilities contacted, owning, leasing, or occupying property or structures in proximity to the site of the work of the Contractor's intention to use explosives.
  3. Drilling equipment will be equipped with suitable dust control apparatus which must be kept in repair and used during all drilling operations.

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4. A copy of the applicable permit approvals of the pre-blast survey and blasting plan obtained by the Contractor shall be submitted to the Owner prior to blasting.
5. Blasting shall not commence until the Owner has secured baseline radon tests.

### 3.4 ROCK EXCAVATION

- A. Rock Excavation - definition - Igneous, metamorphic or sedimentary rock that cannot be removed by rippers or other mechanical methods and, therefore, requires drilling and blasting. Cut rock to form level bearing at bottom of trench. In the utility trenches, excavate to 6" below the invert elevation of pipe.
  1. Reuse excavated materials on-site in accordance with contract documents, if applicable.
- B. Comply with all laws, rules, and regulations of Federal, State and local authorities and insurer which govern storage, use, manufacture, sale, handling, transportation, licensing, or other disposition of explosives. Take special precautions for proper use of explosives to prevent harm to human life and damage to surface structures, all utility lines, or other subsurface structures.
  1. Do not conduct blasting operations until persons in vicinity have had ample notice and have reached positions of safety.
  2. All blasting shall be performed in accordance with all pertinent provisions of the "Manual of Accident Prevention in Construction" issued by the Associated General Contractors of America, Inc., of the "Construction Safety Rules and Regulations," as adopted by the State Board of Construction Safety, Auburn, Maine, and Maine Department of Transportation "Standard Specifications" Section 107.12, Use of Explosives. Blasting through the over burden will not be allowed.
- C. Contractor shall save harmless Owner, Engineer, and Owner's representative from any claim growing out of use of such explosives. Removal of materials of any nature by blasting shall be done in such manner and such time as to avoid damage affecting integrity of design and to avoid damage to any new or existing structure included in or adjacent to work. It shall be the contractor's responsibility to determine method of operation to ensure desired results and integrity of completed work.
- D. Perform rock excavation in a manner that will produce material of such size as to permit it being placed in embankments in accordance with Section 31 20 00. Remove rock to limits as indicated. Remove loose or shattered rock, overhanging ledges and boulders which might dislodge.
- E. Provisions for Blasting

Blasting shall be performed only after approval has been given by the Owner for such operations and must comply with the following provisions:

1. *The Contractor or any subcontractor shall use sufficient stemming, matting or natural protective cover to prevent flyrock from leaving property owned or under control of the owner or operator or from entering protected natural resources or natural buffer strips.*



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*Crushed rock or other suitable material must be used for stemming when available; native gravel, drill cuttings or other material may be used for stemming only if no other suitable material is available.*

2. *The maximum allowable airblast at any inhabited building not owned or controlled by the developer may not exceed 129 decibels peak when measured by an instrument having a flat response (+ or – 3 decibels) over the range of 5 to 200 hertz.*
3. *The maximum allowable airblast at an uninhabited building not owned or controlled by the developer may not exceed 140 decibels peak when measured by an instrument having a flat response (+ or – 3 decibels) over the range of 5 to 200 hertz.*
4. *Monitoring of airblast levels is required in all cases for which a preblast survey is required by paragraph F. The Contractor may file a MeDEP Permit Modification requesting the MeDEP waive the monitoring requirement if the Contractor or subcontractor secures the permission of affected property owners to increase allowable airblast levels on their property and the department determines that no protected natural resource will be adversely affected by the increased airblast levels. The cost to prepare the permit modification and the effect of project delay while MeDEP reviews the request shall be borne solely by the Contractor or his subcontractor.*
5. *If a blast is to be initiated by detonating cord, the detonating cord must be covered by crushed rock or other suitable cover to reduce noise and concussion effects.*
6. *A preblast survey is required and must extend a minimum radius of 500' feet from the blast site. The preblast survey must document any preexisting damage to structures and buildings and any other physical features within the survey radius that could reasonably be affected by blasting. Assessment of features such as pipes, cables, transmission lines and wells and other water supply systems must be limited to surface conditions and other readily available data, such as well yield and water quality. The preblast survey must be conducted prior to the initiation of blasting at the operation. The Contractor or subcontractor shall retain a copy of all preblast surveys for at least one year from the date of the last blast on the development site.*
  - (a) *The Contractor or the subcontractor is not required to conduct a preblast survey on properties for which the owner or operator documents the rejection of an offer by registered letter, return receipt requested, to conduct a preblast survey. Any person owning a building within a preblast survey radius may voluntarily waive the right to a survey.*
7. *Blasting may not occur in the period between sundown and sunrise the following day or in the period 7:00 p.m. and 7:00 a.m., whichever is greater. Routine production blasting is not allowed in the daytime on Sunday. Detonation of misfires may occur outside of these times but must be reported to the department within 5 business days of the misfire*

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*detonation. Blasting may not occur more frequently than 4 times per day. Underground production blasting may be exempted from these requirements provided that a waiver is granted by the department.*

8. *Sound from blasting may not exceed the following limits at any protected location:*

<u>Number of Blasts Per Day</u>	<u>Sound Level Limit</u>
1	129 dbl
2	126 dbl
3	124 dbl
4	123 dbl

9. *The maximum peak particle velocity at inhabitable structures not owned or controlled by the developer may not exceed the levels established in Table 1 in paragraph E and the graph published by the United States Department of the Interior in “Bureau of Mines Report of Investigations 8507,” Appendix B, Figure B-1. The Contractor or subcontractor may apply for a MeDEP Project Modification to request a variance to allow ground vibration levels greater than 2 inches per second on undeveloped property not owned or controlled by the applicant if the department determines that no protected natural resource, unusual natural area or historic site will be adversely affected by the increased ground vibration levels. If inhabitable structures are constructed on the property after approval of the MeDEP and prior to completion of blasting, the Contractor immediately must notify the department and modify blasting procedures to remain in compliance with the standards of this subsection. The cost to prepare the permit modification and the effect of project delay while MeDEP reviews the request shall be borne solely by the Contractor or his subcontractor.*
10. *Table 1 of this paragraph or the graph published by the United States Department of the Interior in “Bureau of Mines Report of Investigations 8507”, Appendix B. Figure B-1 must be used to evaluate ground vibration effects for those blasts for which a preblast survey is required.*
- (a) Either Table 1 of this paragraph or graph published by the United States Department of the Interior in “Bureau of Mines report of Investigations 8507”, Appendix B, Figure B-1 may be used to evaluate ground vibration when blasting is to be monitored by seismic instrumentation.*
  - (b) Blasting measured in accordance with Table 1 of this paragraph must be conducted so that the peak particle velocity of any one of the 3 mutually perpendicular components of motion does not exceed the ground vibration limits at the distances specified in Table 1 of this paragraph.*
  - (c) Seismic instruments that monitor blasting in accordance with Table 1 of this paragraph must have the instrument’s transducer firmly coupled to the ground.*

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- (d) *An owner or operator using Table 1 of this paragraph must use the scaled-distance equation,  $W=(D/D_s)^2$ , to determine the allowable charge weight of explosives to be detonated in any 8 millisecond or greater delay period without seismic monitoring, where W is equal to the maximum weight of explosives, in pounds, and D and  $D_s$  are defined as in Table 1 of this paragraph. The Contractor may apply for a Permit Modification to MeDEP to authorize the use of a modified scaled-distance factor for production blasting if the contractor can demonstrate to a 95% confidence level, based upon records of seismographic monitoring at the specific site of the mining activity covered by the permit, that use of the modified scaled-distance factor will not cause the ground vibration to exceed the maximum allowable peak particle velocities of Table 1 of this paragraph. The cost to prepare the permit modification and the effect of project delay while MeDEP reviews the request shall be borne solely by the Contractor or his subcontractor.*
- (e) *Blasting monitored in accordance with the graph published by the United States Department of the Interior in “Bureau of Mines Report of Investigations 8507”, Appendix B, Figure B-1 must be conducted so that the continuously variable particle velocity criteria are not exceeded.*

*The Contractor may apply for a Permit Modification to MeDEP for a variance of the ground vibration monitoring requirement prior to conducting blasting at the development site if the Contractor agrees to design all blasts so that the weight of explosives per 8 millisecond or greater delay does not exceed that determined by the equation  $W=(D/D_s)^2$ , where W is the maximum allowable weight of explosives per delay of 8 milliseconds or greater, D is the shortest distance between any area to be blasted and any inhabitable structure not owned or controlled by the developer, and  $D_s$  equals 70 ft./lb.<sup>1/2</sup>. As a condition of the variance, the department may require submission of records certified as accurate by the blaster and may require the owner or operator to document compliance with the conditions of this paragraph. The cost to prepare the permit modification and the effect of project delay while MeDEP reviews the request shall be borne solely by the Contractor or his subcontractor.*

*The following is Table 1.*

<b>Distance Versus Peak Particle Velocity Method</b>		
<b>Distance (D) from the blast area</b>	<b>Maximum allowable peak particle velocity (Vmax) for ground vibration (in./sec.)</b>	<b>Scaled-distance factor (Ds) to be applied without seismic monitoring</b>
0 to 300	1.25	50
301-5000	1.00	55
Greater than 5000	0.75	65

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11. *A record of each blast, including seismographic data, must be kept for at least one year from the date of the last blast, must be available for inspection at the development or at the offices of the owner or operator if the development has been closed, completed or abandoned before the one-year limit has passed and must contain at a minimum the following data:*
  - (a) Name of blasting company or blasting contractor;*
  - (b) Location, date and time of blast;*
  - (c) Name, signature and social security number of blaster;*
  - (d) Type of material blasted;*
  - (e) Number and spacing of holes and depth of burden or stemming;*
  - (f) Diameter and depth of holes;*
  - (g) Type of explosives used;*
  - (h) Total amount of explosives used;*
  - (i) Maximum amount of explosives used per delay period of 8 milliseconds or greater;*
  - (j) Maximum number of holes per delay period of 8 milliseconds or greater;*
  - (k) Method of firing and type of circuit;*
  - (l) Direction and distance in feet to the nearest dwelling, public building, school, church or commercial or institutional building neither owned nor controller by the developer;*
  - (m) Weather conditions, including such factors as wind direction and cloud cover;*
  - (n) Height or length of stemming;*
  - (o) Amount of mats or other protection used;*
  - (p) Type of detonators used and delay periods used;*
  - (q) The exact location of each seismograph and the distance of each seismograph from the blast;*
  - (r) Seismographic readings;*
  - (s) Name and signature of the person operating each seismograph; and*
  - (t) Names of the person and the firm analyzing the seismographic data.*
  
12. *All field seismographs must record the full analog wave form of each of the 3 mutually perpendicular components of motion in terms of particle velocity. All seismographs must be capable of sensor check and must be calibrated according to the manufacturer's recommendations.*

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### 3.5 SPECIAL PERIMETER CONTROL BLASTING PROCEDURES

- A. When blasting at the perimeter of the excavation area, care shall be taken at the excavation limits to minimize over-breakage and fracturing of remaining rock. Pre-splitting or cushion blasting or line drilling shall be utilized at such locations and/or as indicated on the Drawings as described as follows.
- B. If, in the judgment of the Engineer, the Contractor's perimeter control blasting procedures are causing rock fracturing at a distance beyond the limits of work, the geometry (diameter, spacing), stemming and loading of perimeter holes and adjacent production holes shall be adjusted until results acceptable to the Engineer are obtained or the perimeter control blasting technique shall be changed. The following descriptions of pre-splitting, cushion blasting and line drilling should be considered general guidelines. The Contractor shall use appropriate methods to conduct the work based on his experience, the project requirement and site conditions.
- C. The perimeter controlled blasting procedures shall be employed in areas where a permanent rock slope is to be constructed for site grading and other critical areas. Perimeter rock slopes steeper than 1H:4V and taller than 5 ft. in overall vertical height as shown on the Drawings shall require special controlled blasting procedures.
- D. The purpose of the perimeter controlled blasting is to pre-split the rock along the designated cut face to produce a uniform plane of rupture so that the resulting face (permanent face) will not be affected by subsequent fragmentation blasting and excavation operations. The Contractor shall adjust the blasting operations according to the characteristic and structure of the rock formation to obtain the required slope without fracturing the rock beyond the pre-split face.
- E. Pre-Splitting
  1. Pre-splitting rock shall, at a minimum, conform to the *Maine Highway Department-Standard Specifications for Highways and Bridges. Section 203.04 – Pre-splitting Rock* shall be used for this project on 1:6 slopes.
  2. Pre-split blast holes shall be loaded and fired separately before the main round to create a fracture plane along the perimeter of the excavation.
  3. Pre-split holes shall be string-loaded or space-loaded with light, distributed charges and shall be thoroughly stemmed for the full length of hole with sand. The top of the hole, for a minimum 18 inches, shall be unloaded and stemmed with tamped sand and gravel.
  4. Spacing, burden, hole diameter and loading shall be maintained within the Guidelines listed in Table I unless deviated from the Guidelines is approved by the Engineer based on field performance.

TABLE I  
PRE-SPLITTING GUIDELINES

HOLE DIAMETER (in)	HOLE SPACING (ft)	COLUMN LOAD CHARGE CONCENTRATION (lb/ft)
1.5 to 2.5	1.0 to 1.5	0.06 to 0.15
3.0 to 4.0	1.5 to 2.0	0.10 to 0.20

5. The bottom charge concentration within the bottom 1 to 3 ft. of hole shall be approximately three (3) times the column charge concentration.
6. Pre-split holes shall be fired simultaneously if particle velocity and air blast considerations will permit. Otherwise, groups of pre-split holes in segments along the pre-split line shall be systematically fired with millisecond (ms) delays.
7. Pre-split holes shall not deviate more than 6 inches out of alignment over the full maximum vertical lift height.
8. Loading of the first-row-in of production holes shall be approximately 50 to 75% of normal production hole loading.

F. Cushion Blasting

1. If used, cushion blast holes shall be loaded and fired separately after the main round to ensure a free face and equal burden.
2. Cushion blast holes shall be string-loaded or space-loaded with light charges, and shall be thoroughly stemmed with a maximum of 18 inches of tamped sand, peastone or other material capable of maintaining explosive gas pressures. Spacing, burden, blast hole diameter and loading shall be maintained within the Guidelines outlined in Table II.

TABLE II  
CUSHION BLASTING GUIDELINES

HOLE DIAMETER (in)	SPACING (ft)	BURDEN (ft)	COLUMN LOAD CHARGE CONCENTRATION (ob/ft)
1.5 to 2.0	1.0 to 1.5	2.5 to 3.0	0.06 to 0.15
2.5 to 4.0	1.5 to 2.0	3.0 to 3.5	0.15 to 0.25

NOTE: Small diameter, unloaded guide holes shall be used if required for satisfactory results, located midway between each cushion blast hole.

3. The first row of drill holes in from the perimeter row shall be loaded with not more than four (4) times the charge weight indicated in the Table. Spacing and burden of the first-row-in holes shall be decreased sufficiently from those of other production holes to ensure that the perimeter holes have a free face and equal burden for the full depth of the round.

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### G. Line Drilling

1. Line drilling shall consist of a minimum of 3-inch diameter holes evenly spaced at 2 per lineal foot. Drill holes shall not be deviated by more than 3-inches from their required plane over the entire length of the hole. The line-drilled holes are to be left unloaded. As the perimeter is approached with the primary blasting, the distance should be about 50% of the normal hole spacing. The spacing of holes in the row adjacent to the perimeter holes shall also be about 50-75% of the normal hole spacing. The loading of the holes in the adjacent row should be about 50% of the loading used in the primary holes.

### H. Condition of the Permanent Rock Face

1. The permanent rock face shall not deviate by more than 5% batter and 2 ft. in plan location as shown on the Drawings. Loose, fractured or over-hanging rock as determined by the Engineer to be unstable shall be removed as directed. Care shall be taken during the excavation to minimize over-breakage and fracturing.

**END OF SECTION**

**SECTION 31 23 19**

**DEWATERING**

**PART 1 – GENERAL**

**1.1 SUMMARY**

- A. This Section includes construction dewatering.

**1.2 PERFORMANCE REQUIREMENTS**

- B. Dewatering Performance: Design, furnish, install, test, operate, monitor, and maintain dewatering system of sufficient scope, size, and capacity to control groundwater flow into excavations, to permit construction to proceed on stable subgrades and to restrict the flow of surface water into the excavation.

**1.3 SUBMITTALS**

- A. Shop Drawings for Information: For dewatering system. Show arrangement, locations, and details of wells and well points; locations of headers and discharge lines; and means of discharge and disposal of water, piles, slurry walls, or other formal dewatering systems.
  - 1. Include Shop Drawings signed and sealed by the qualified professional engineer responsible for their preparation.

**1.4 QUALITY ASSURANCE**

- A. Regulatory Requirements: Comply with water disposal requirements of authorities having jurisdiction.
- B. Discharge all pumped water through a Dirtbag® or equal.
- C. Comply with all OSHA and other safety regulations.

**PART 2 - PRODUCTS (VACANT)**

**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.



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1. Prevent surface water and subsurface or groundwater 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.

### 3.2 INSTALLATION

- A. Install dewatering system utilizing wells, well points, sumps, or similar methods complete with pump equipment, standby power and pumps, filter material gradation, valves, appurtenances, water disposal, and surface-water controls.
- B. Before excavating below groundwater 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 24 inches 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 in a manner that avoids inconvenience to others. Provide sumps, sedimentation tanks, Dirtbag® 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 below overlying construction.
- G. Damages: Promptly repair damages to adjacent facilities caused by dewatering operations.

**END OF SECTION**

**SECTION 31 25 13**

**EROSION CONTROLS**

**PART 1 - GENERAL**

**1.1 SECTION INCLUDES**

- A. Temporary and permanent erosion control systems.
- B. Slope Protection Systems.

**1.2 RELATED SECTIONS**

- A. Section 31 10 00 – Site Clearing
- B. Section 31 20 00 – Earth Moving
- C. Construction Requirements
- D. Soil Management Plan

**1.3 ENVIRONMENTAL REQUIREMENTS**

- A. The Site Contractor shall protect adjacent properties and water resources from erosion and sediment damage throughout the life of the construction contract in accordance with the Erosion and Sediment Control plan, details and notes prepared for this project and in accordance with the requirements of the City of Portland's Permit and conditions of approval. The Erosion and Sediment Control plan, notes and details and Site Permits have specific restrictions on work which must be completed prior to the start of other construction, seasonal work limits, the amount of area which can be exposed at a given time, the general sequence of construction, and Site Contractor monitoring responsibilities for documenting compliance with the erosion control plan for this project. These affect the scheduling of the work.

Protected resources as referred to in this document include wetlands, streams or water bodies, and trees or vegetation outside of the work limit.

Prior to grubbing, orange safety fence shall be installed between the limit of grading and any protected resource. When the protected resource is a tree, the safety fence shall be installed at the drip line of the tree. If disturbance of the root system occurs, the Site Contractor shall have an Arborist or Nurseryman inspect the root system and provide recommendations to preserve the tree. This information shall be included in the logs for the Erosion Control Plan maintained by the Site Contractor.

- B. The Site Contractor will be required to designate, by name, a suitably qualified individual, responsible for implementation of all erosion control measures as required by current local, State and federal regulations and this specification.

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Specific responsibilities will include:

1. Assuring and certifying the Site Contractor's construction sequence is in conformance with the specified schedule. In addition, a weekly certification stating compliance, any deviations, and corrective measures shall be filed with the owner by this person. A copy of the certification form is contained the Erosion and Sedimentation Control plan, details and notes.
  2. Inspection of the project work site on a weekly basis, with the installation of added erosion control measures in areas which appear vulnerable to erosion. The erosion and sediment measures shown on the contract documents are minimum provisions. Any additional measures required to comply with the permit or intent of the Erosion and Sedimentation Control plan shall be incidental to the contract.
  3. Inspection of all erosion control measures and drainage inlets after any significant rainfall. Accumulated silt/sediment should be removed when the depth of sediment reaches 50 percent of the barrier height. Accumulated silt/sediment should be removed from behind silt fencing when the depth of the sediment reaches 6 inches. A significant rainfall shall be defined as over ½ inch of precipitation in any consecutive 24-hour period.
  4. Inspect areas for catch of grass. A minimum catch of 90 percent is required prior to removal of erosion control measures.
  5. Maintaining precipitation records and monitoring forecast activity.
- C. It shall be the responsibility of the Site Contractor to implement, maintain, monitor and document compliance with the erosion and sediment control plan for the project and to avoid turbid discharges from the site, to avoid fugitive dust emissions, to avoid sediment from leaving the site, or affecting areas outside of the project work limits.

The work includes the submission of logs and photographic evidence of compliance with the plan at the time each pay requisition is submitted. These records shall be certified as complying with the Erosion Control Plan and this specification. Deficiencies in the logs or photographic records identified by the Owner or Engineer shall be corrected before the pay requisition is processed.

The photographic documentation must include:

1. A minimum of 10 digital photos per week showing the appropriate erosion control measures in place.
2. Evidence of stabilization of areas that are not being actively worked.
3. Documentation of any observed releases of turbid runoff or failure of any erosion control measure.

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- D. The erosion control measures specified are required to be installed in accordance with the details provided with the construction plans and manufacturer's recommendations. The method and details of the installation of these erosion control methods are of vital importance to insure the effectiveness of the erosion control measures. While precipitation amounts cannot be predicted, the Erosion Control Plan is designed to minimize erosion by restricting the amount of the site that can be open at a given time, limiting the period that an area can be open without stabilization, and requiring weather forecasts to be monitored. It is a requirement of the contract documents that these methods be incorporated on the site.

### PART 2 - PRODUCTS

#### 2.1 MATERIALS

- A. Quick growing grasses for temporary seeding (see seed mixes contained in Erosion and Sedimentation Notes).
- B. Hay or straw bales.
- C. Fencing for siltation control as specified on the plans. Mirafi prefabricated silt fence, straw wattles or approved equal.
- D. Curlex blankets by American Excelsior Company or approved equal. Curlex single net except Curlex double net in winter months.
- E. Bale stakes shall be a minimum of 4 feet in length and 1" in width.
- F. Temporary mulches such as loose hay, straw, netting, wood cellulose or agricultural siltage.
- G. Fence stakes shall be metal stakes a minimum of 8 feet in length.
- H. Stone Sediment Barriers or SiltSacks™, or approved equal for inlet protection.
- J. A stabilized construction entrance to be constructed of the materials identified on the contract drawings.
- K. Calcium chloride and water for dust control.
- L. DIRTBAG® as outlined on the contract drawings and specified in Section 31.
- M. Catch basin inserts. SiltSacks™ or approved equal.
- N. Sorbent booms. Ecotech "Hula" Bug or equal. (N.I.C.)
- O. DirtGlue™ Polymar Emulsion Mixes. DirtGlue™ emulsion formulation must be approved by Owner prior to installation.

### PART 3 - EXECUTION

#### 3.1 PREPARATION

- A. Review site erosion control plan attached to this section of the specifications.

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- B. Deficiencies or changes in the erosion control plan as it is applied to current conditions will be brought to the attention of the Engineer and Owner and a remedial action prepared and implemented by the Contractor.

### 3.2 EROSION CONTROL AND SLOPE PROTECTION IMPLEMENTATION

- A. Provide catalog cuts and information concerning the erosion control products which will be used for construction for review by the Owner.
- B. Provide information concerning the installation of the erosion sedimentation control including anchorage trench provisions anchorage devices, and spacing for review by the Owner.
- C. Place erosion control systems in accordance with the erosion control plan and in accordance with approved installation procedures.
- D. This contract limits the surface area of erodible earth material exposed any time by clearing and grubbing, excavation, borrow and embankment operations. The Owner has the authority to direct the Site Contractor to provide immediate permanent or temporary pollution control measures. The Site Contractor will be required to incorporate all permanent erosion control features into the project at the earliest practical time to minimize the need for temporary controls. Cut slopes shall be permanently seeded and mulched as the excavation proceeds to the extent considered desirable and necessary to comply with the erosion control plan.
- E. The temporary erosion control systems installed by the Site Contractor shall be maintained to control siltation at all times during the life of the Contract. The Site Contractor must respond to any maintenance or additional work to comply with this specification within a 48-hour period.
- F. DIRTBAGS® are required for the discharge of any construction dewatering or pumping, and the DIRTBAG® shall be operational before any trenching.
- G. Certain erosion control measures require staged restoration. For example, reinforced cuts must be completed in 5-foot vertical increments.
- H. Fugitive dust shall be controlled through construction.
- I. Sorbent booms must be installed in the catch basin before paving. These shall be replaced prior to requesting substantial completion. (N.I.C.)
- J. DirtGlue™ may be substituted to the Engineer for approval when DirtGlue™ is to be substituted for mulch, dust control, and other erosion controls of the emulsion mix, application rate, and weather condition that exist at the time of proposed installation must be approved by the Engineer.

### 3.3 CONSTRUCTION OF TEMPORARY EROSION CONTROL MEASURES

- A. Perimeter Dike/Swale Construction
  - 1. All perimeter dike/swale shall have uninterrupted positive grade to an outlet.

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2. Diverted runoff from a disturbed area shall be conveyed to a sediment trapping device.
3. Diverted runoff from an undisturbed area shall outlet into an undisturbed stabilized area at non-erosion velocity.
4. The swale shall be excavated or shaped to line grade and cross section as required to meet the criteria specified in the standard.
5. Stabilization of the area disturbed by the dike and swale shall be done in accordance with the standard and specifications for temporary seeding and mulching, and shall be done within 10 days.
6. Periodic inspection and required maintenance must be provided after each rain event.

Max. Drainage Area Limit: 2 Acres.

### B. Silt Fence Construction

1. Woven wire fence to be fastened securely to fence posts with wire ties or staples. Posts shall be steel either 'T' or 'U' type or hardwood.
2. Filter cloth to be fastened securely to woven wire fence with ties spaced every 24" at top and mid section. Fence shall be woven wire, 12 ½ gauge, 6" maximum mesh opening.
3. When two sections of filter cloth adjoin each other, they shall be overlapped by six inches and folded. Filter cloth shall be either Filter X, Mirafi 100X, Stabilinka T140N, or approved equivalent.
4. Prefabricated units shall be Geofab, EnviroFence, or approved equivalent.
5. Maintenance shall be performed as needed and material removed when 'bulges' develop in the silt fence.

### C. Stabilized Construction Entrance

1. Stone Size – Use 2" stone, or reclaimed or recycled concrete equivalent.
2. Length – Not less than 50 feet (except on a single residence lot where a 30 foot minimum length would apply).
3. Thickness – Not less than six (6) inches.
4. Width – Twelve (12) foot minimum, but not less than the full width at points where ingress or egress occurs. Twenty-four (24) foot if single entrance to site.
5. Filter Cloth – Will be placed over the entire area prior to placing of stone.
6. Surface Water – All surface water flowing or diverted toward construction entrances shall be piped across the entrance. If piping is impractical, a mountable berm with 5:1 slopes will be permitted.
7. Maintenance – The entrance shall be maintained in a condition which will prevent tracking or flowing of sediment onto public rights-of-way, all sediment spilled, dropped, washed or tracted onto public rights-of-way must be removed immediately.
8. When washing is required, it shall be done on an area stabilized with stone and which drains into an approved sediment trapping device.

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9. Periodic inspection and needed maintenance shall be provided after each rain.

**D. Sump Pit Construction**

1. Pit dimensions are optional.
2. The standpipe should be constructed by perforating a 12-24" diameter corrugated or PVC pipe.
3. A base of 2" aggregate should be placed in the pit to a depth of 12" after installing the standpipe, the pit surrounding the standpipe should be backfilled with 2" aggregate.
4. The standpipe should extend 12-18" above the lip of the pit.
5. If discharge will be pumped directly to a storm drainage system, the standpipe should be wrapped with filter cloth before installation. If desired, ¼" – ½" hardware cloth may be placed around the standpipe, prior to attaching the filter cloth.

**1.4 MULCH ANCHORING REQUIREMENTS**

<b>Anchoring Method or Material</b>	<b>Kind of Mulch to be Anchored</b>	<b>How to Apply</b>
Peg and Twine	Hay or straw	After mulching, divide areas into blocks approximately 1 sq. yd. in size. Drive 4-6 pegs per block to within 2" to 3" of soil surface. Secure mulch to surface by stretching twine between pegs in crisscross pattern on each block. Secure twine around each peg with 2 or more tight turns. Drive pegs flush with soil. Driving stakes into ground tightens the twine.
Mulch Netting	Hay or straw	Staple the light-weight paper, jute, wood fiber, or plastic nettings to soil surface according to manufacturer's recommendations. Should be biodegradable. Most products are not suitable for foot traffic.
Wood Cellulose Fiber	Hay or Straw	Apply with hydro seeder immediately after mulching. Use 500 lbs. Wood fiber per acre. Some products contain an adhesive material, possible advantageous.
Mulch Anchoring Tool	Hay or Straw	Apply mulch and pull a mulch anchoring tool (blunt, straight discs) over mulch as near to the contour as possible. Mulch material should be "tucked" into soil surface about 3".
Chemical	Hay or Straw	Apply Terra Tack AR 120 lbs./ac. in 480 gal. of water (#156/ac.) or Aerospray 70 (60 gal/ac.) according to manufacturer's instructions. Avoid application during rain. A 24-hour curing period and a soil temperature higher than 45° Fahrenheit are required.

**END OF SECTION**

SECTION 31 25 73

DIRTBAG® SPECIFICATIONS FOR CONTROL OF SEDIMENT

PART 1 - GENERAL

1.1 DESCRIPTION

- A. This work shall consist of furnishing, placing and removing the DIRTBAG® pumped sediment control device for erosion-sediment control. The DIRTBAG® pumped-silt control system is marketed by:

ACF Environmental, Inc.  
 2831 Cardwell Drive  
 Richmond, Virginia 23234  
 Phone: 800-448-3636  
 Fax: 804-743-7779

- B. Four (4) DIRTBAGS® shall be included as part of the base bid.

PART 2 - MATERIALS

2.1 DIRTBAG®

- A. The DIRTBAG® shall be a non-woven bag which is sewn with a double needle matching using a high strength thread.
- B. The DIRTBAG® seams shall have an average wide width strength per ASTM D-4884 as follows.

<u>DIRTBAG® Style</u>	<u>Test Method</u>	<u>Test Result</u>
DIRTBAG® 53	ASTM D-4884	60 LB/IN
DIRTBAG® 55	ASTM D-4884	100 LB/IN

- C. Each standard DIRTBAG® shall be supplied with fill spout large enough to accommodate a 4” discharge hose and straps to secure the hose and prevent pumped water from escaping without being filtered.
- D. The geotextile fabric shall be non-woven fabric with the following properties:

Properties	Test Method	Units	Non-Woven	
			53	55
Weight	ASTM D-3776	Oz/yd	8	10
Grab Tensile	ASTM D-4632	Lbs.	203	250
Puncture	ASTM D-4833	Lbs.	130	165
Flow Rate	ASTM D-4491	Gal/Min/Ft2	80	70
Permittivity	ASTM D-4491	Sec. <sup>1</sup>	1.5	1.3



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Properties	Test Method	Units	Non-Woven	
			53	55
Mullen Burst	ASTM D-3786	Lbs. <sup>in</sup> 2	400	550
UV Resistant	ASTM D-4355	%	70	70
AOS % Retained	ASTM D-4751	%	100	100

*All properties are minimum average roll value except the weight of the fabric which is given for information only.*

### PART 3 – CONSTRUCTION SEQUENCE

- 3.1 Install DIRTBAG® on a prepared crushed stone pad overlying Mirafi 600X as shown on the contract drawings. Strap the neck of the DIRTBAG® tightly to the discharge hose. The preparation of a DIRTBAG® area is required before any trenching. Any water pumped from the construction site must be discharged through a DIRTBAG®.
- 3.2 It may be necessary to use hay/poly or other measures to keep the DIRTBAG® from freezing during winter months.
- 3.3 The DIRTBAG® is full when it no longer can efficiently filter sediment or pass water at a reasonable rate. Flow rates will vary depending on the size of the DIRTBAG®, the type and amount of sediment discharged into the DIRTBAG®, the type of ground, rock or other substance under the bag and the degree of the slope on which the bag lies. Under most circumstances, the vendor claims DIRTBAGS® will accommodate flow rates of 1,500 gallons per minute. Use of excessive flow rates or overfilling DIRTBAG® with sediment will cause ruptures of the bags or failure of the hose attachment straps.
- 3.4 Dispose of DIRTBAG® in accordance with Local, State, and Federal regulations. If allowed, the DIRTBAG® may be cut open and the contents seeded after removing visible fabric. DIRTBAG® is strong enough to be lifted with added straps if it must be hauled away (extra option). Off-site disposal may be facilitated by placing the DIRTBAG® in the back of the dump truck or flatbed prior to use and allowing the water to drain from the bag in place, thereby dismissing the need to lift the DIRTBAG®.

**END OF SECTION**

**SECTION 32 11 00**

**BASE COURSES**

**PART 1 - GENERAL**

**1.1 SECTION INCLUDES**

- A. Granular Base and Subbase (also referred to as base and subbase aggregates or base and subbase gravels).

**1.2 RELATED REQUIREMENTS**

- A. Section 31 10 00 – Site Clearing
- B. Section 31 20 00 – Earth Moving
- C. Section 32 12 16 – Asphaltic Paving
- D. Section 32 16 15 – Curbs and Sidewalks

**1.3 REFERENCES**

- A. ANSI/ASTM D698 - Test Methods for Moisture-Density Relations of Soils and Soil-aggregate Mixtures, Using 5.5 lb (2.49 Kg) Rammer and 12 inch (304.8 mm) Drop.
- B. ANSI/ASTM D1557 - Test Methods for Moisture-Density Relations of Soils and Soil-Aggregate Mixtures Using 10 lbs (4.54 Kg) Rammer and 18 inch (457 mm) Drop.
- C. ASTM D2167 - Test for Density and Unit Weight of Soil in Place by the Rubber Balloon Method.
- D. ASTM D1556 - Test Method for Density of Soil in-place by the Sand-Cone Method.
- E. ASTM D2922 - Test Methods for Density of Soil and Soil-Aggregate in Place by Nuclear Methods (Shallow Depth) Method B (Direct Transmission).
- F. ASTM D3017 - Test Methods for Moisture Content of Soil and Soil-Aggregate Mixtures.

**PART 2 - PRODUCTS**

**2.1 FILL MATERIALS**

- A. Submit materials certificate to on-site independent testing laboratory which is signed by material producer and Contractor, certifying that materials comply with, or exceed, the requirements herein. Materials shall comply with the gradations specified in Section 31 20 00, Earth Moving.

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### PART 3 - EXECUTION

#### 3.1 EXAMINATION

- A. Verify substrate has been inspected; gradients and elevations are correct, and dry.

#### 3.2 CONSTRUCTION

- A. Perform base and subbase course construction in a manner that will drain surface properly at all times and at same time prevent runoff from adjacent areas from draining onto base course or subbase construction.
- B. Compact base material to not less than 95% of maximum density as determined by ASTM D-1557 unless otherwise indicated on the Drawings.
- C. Granular Subbase: Construct to thickness indicated on Drawings; apply in lifts or layers not exceeding 8", measured loose.
- D. Granular Base: Construct to thickness indicated on Drawings. Apply in lifts or layers not exceeding 4" measured loose.
- E. All work of this section shall conform to the requirements of Sections 304 of the Maine Department of Transportation Specification for furnishing, placing, and surface tolerance of aggregate base and subbase courses.

#### 3.3 FIELD QUALITY CONTROL

- A. An Independent Testing Laboratory, retained by the Owner, shall perform construction testing of in-place base courses for compliance with requirements for gradation and density. The Contractor shall retain an independent surveyor to verify paving base course tolerances (by rod and level readings on no more than fifty-foot centers) to +0.05' of design elevation that allow for paving thickness as shown in the Drawings. Contractor shall provide instruments and a suitable benchmark and perform all survey. The Contractor may, at his option, retain his own test laboratory for quality control, production schedules, or for any other reason at no cost to the Owner.
- B. The following tests shall be performed on each type of material used as base and subbase course material:
  - 1. Moisture and Density Relationship: ASTM D 698 or ASTM D 1557.
  - 2. Mechanical Analysis: AASHTO T-88
  - 3. Plasticity Index: ASTM D-4318-84
  - 4. Base and subbase material thickness: Perform one test for each 5,000 square feet in-place base material area.

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5. Base and subbase material compaction: Perform one test in each lift for each 5,000 square feet in-place base material area.
  6. Test each source of base material for compliance with applicable state highway specifications.
- C. Field density tests for in-place materials shall be performed according to one of the following standards as part of construction testing requirements:
1. Sand-Cone Method: ASTM D1556
  2. Balloon Method: ASTM D2167
  3. Nuclear Method: ASTM D2922, Method B (Direct Transmission).
- D. Independent Testing Laboratory shall prepare test reports that indicate test location, elevation data, and test results. The Engineer, Owner, and Contractor shall be provided with copies of reports within 96 hours of time test was performed. In event that any test performed fails to meet these Specifications, the Owner and Contractor shall be notified immediately by Independent Testing Laboratory. The Owner reserves right to employ a separate testing laboratory and to direct any testing that is deemed by them to be necessary. Contractor shall provide free access to site for testing activities.
- E. Any base or subbase courses which become contaminated due to weather, erosion, or other activities, whether or not such contamination is under the control of the Contractor shall be removed and replaced. Said removal and replacement shall be incidental to the work and no additional payment will be made to the Contractor.

**END OF SECTION**

**SECTION 32 12 16**

**ASPHALTIC PAVING**

**PART 1 - GENERAL**

**1.1 SECTION INCLUDES**

- A. Provide all material and labor for the placement of surface course and binder course on roads, access drives, parking lots, sidewalks, and walkways. All pavement shall be produced, supplied, placed and conform to the requirements of Section 401 of the MaineDOT Standard Specifications.

**1.2 REFERENCES**

- A. November 2014 State of MaineDOT Standard Specifications, including relevant updates, except as modified herein.
- B. November 2014 State of MaineDOT Standard Details.
- C. MS-2 - Mix design methods for asphalt concrete and other hot mix types - The Asphalt Institute (AI).
- D. MS-3 - Asphalt Plant Manual - The Asphalt Institute (AI).
- E. Hot Mix Asphalt Paving Handbook - US Army Corp of Engineers, UN-13 (CE MP-ET).
- F. MS-19 - Basic Asphalt Emulsion Manual - The Asphaltic Institute (AI).
- G. ASTM D946 - Penetration - Graded Asphalt Cement for use in Pavement Construction.
- H. AASHTO M-226/ASTM D3381 Asphalt Cement
- I. AASHTO M-140/ASTM D997 or AASHTO M-208/ASTM D-2397 Tack Coat
- J. AASHTO M-117/ASTM D242 Mineral Filler
- K. AASHTO T-245/ASTM D1559 Marshall Mix Design
- L. Approved and released for construction plans (for State Highway work, there may be a difference between "Released for Bid" and "Approved and Released for Construction" drawings. Any substantive changes shall be addressed by approved change order before commencing the work).

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### **1.3 RELATED SECTIONS**

- A. Section 31 20 00 – Earth Moving
- B. Section 32 11 00 – Base Courses
- C. Section 32 16 15 – Curbs and Sidewalks

### **1.4 SUBMITTALS**

- A. Design Mix: Before any asphaltic concrete paving is constructed, the Contractor shall submit the proposed actual design mix to the Owner for review and/or approval. Design mix submittal shall follow the format as indicated in the Asphalt Institute Manual MS-2, Marshall Stability Method; and shall include the type/name of the mix, gradation analysis, asphalt cement grade used, Marshall Stability (lbs), flow, effective asphalt content (percent), and direct references to the applicable highway department specifications sections for each material. Design shall be for a mixture listed in the most recent edition of roadway specifications of the state in which the project is to be constructed. In no case shall a mix design over three years old be submitted.
- B. Material Certificates: Submit materials certificate to an independent testing laboratory retained by the Owner. The certificates shall be signed by the material producer and Contractor, certifying that materials comply with, or exceed, the requirements herein.
- C. Field density test results, minimum 1 per 100 tons of bituminous pavement placed including station/offset of test.
- D. Plant inspection reports to verify pavement batch plant and paving equipment meets or exceeds MDOT Specification 401. The inspections shall be conducted by an independent testing firm retained by the Owner.

### **1.5 JOB CONDITIONS**

- A. Weather Limitations:
  - 1. Apply tack coats when ambient temperature is above 40 degrees F, and when temperature has been above 35 degrees F for 12 hours immediately prior to application.
  - 2. Construct asphaltic concrete paving when atmospheric temperature is above 40 degrees F base, 50 degrees F surface.

## **PART 2 - PRODUCTS**

### **2.1 MATERIALS**

- A. Provide asphaltic concrete mixture as recommended by local or state paving authorities to suit project conditions. Use locally available materials and gradations which meet State Department of Transportation specifications and exhibit satisfactory record on previous installations.

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- B. Asphalt Cement: Comply with AASHTO M-226/ASTM D 3381; Table 2 AC-10, AC-20, or AC-30, AR-80, viscosity grade, depending on local mean annual air temperature. (See following chart):

Temperature Condition	Asphalt Grades
Cold, mean annual air temperature < 7° C (45° F)	AC-10 85/100 pen.
Warm, mean annual air temperature between 7° C (45° F) and 24° C (75° F)	AC-20 60/70 pen.
Hot, mean annual air temperature > 24° C (57° F)	AC-30

Final acceptance of the proper grade of A.C. shall be made by the Owner's Engineer.

- C. Tack Coat: Emulsified asphalt; AASHTO M-140/ASTM D 997 or M 208/ASTM D 2397, SS-1h, CSS-1, or CSS-1h, diluted with one part water to one part emulsified asphalt.
- D. Mineral Filler: Rock or slag dust, hydraulic cement, or other inert material complying with AASHTO M-17/ASTM D242, if recommended by applicable state highway standards.
- E. Asphalt-Aggregate Mixture: See drawings and details – all materials must meet current Maine DOT Standards and Specifications.

### 2.2 EQUIPMENT

- A. Maintain all batch plant and paving equipment in satisfactory operating condition and correct breakdowns in a manner that will not delay or be detrimental to progress of paving operations.

## PART 3 - EXECUTION

### 3.1 PREPARATION

- A. Remove loose material from compacted base material surface immediately before applying prime coat.
- B. Proof roll prepared base material surface to check for areas requiring additional compaction and areas requiring removal and recompaction.
- C. Do not begin paving work until deficient base material areas have been corrected and are ready to receive paving.

### 3.2 APPLICATIONS

- A. Tack Coat:
1. Apply to contact surfaces of previously constructed asphaltic concrete base courses or Portland cement concrete and surfaces abutting or projecting into asphalt concrete and surfaces abutting or projecting into asphalt concrete pavement.

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2. Apply tack coat to asphaltic concrete base course or sand asphalt base course. Apply emulsified asphalt tack coat on the surface of all such bases where asphaltic concrete paving will be constructed.
3. Apply emulsified asphalt tack coat in accordance with APWA Section 2204 and applicable state highway specifications.
4. Apply at minimum rate of 0.05 gallon per square yard of surface.
5. Allow to dry until at proper condition to receive paving.

### 3.3 ASPHALTIC CONCRETE PLACEMENT

- A. Place asphalt concrete mixture on completed compacted subgrade surface, spread, and strike off. Spread mixture at following minimum temperatures:
  1. When ambient temperature is between 40 degrees F and 50 degrees F: 285 degrees F.
  2. When ambient temperature is between 50 degrees F and 60 degrees F: 280 degrees F.
  3. When ambient temperature is higher than 60 degrees F: 275 degrees F.
- B. Whenever possible, all pavement shall be spread by a finishing machine. Inaccessible or irregular areas, pavement may be placed by hand methods. The hot mixture shall be spread uniformly to the required depth with hot shovels and rakes. After spreading, the hot mixture shall be carefully smoothed to remove all segregated coarse aggregate and rake marks. Rakes and lutes used for hand spreading shall be of the type designed for use on asphalt mixtures. Loads shall not be dumped faster than they can be properly spread. Workers shall not stand on the loose mixture while spreading.
- C. Paving Machine Placement: Apply successive lifts of asphaltic concrete in transverse directions with the surface course placed in the direction of surface-water flow. Place in typical strips not less than 10'-0" wide.
- D. Joints: Make joints between old and new pavements, or between successive days' work, to ensure continuous bond between adjoining work. Construct joints to have same texture, density, and smoothness as other sections of asphalt concrete course. Clean contact surfaces and apply tack coat.

### 3.4 WEATHER AND SEASONAL LIMITATIONS

For weather limitations, the State of Maine will be considered to be divided into two paving zones:

- (a) Zone 1: All area north of US Route 2 from Gilead to Brewer and north of Route 9 from Brewer to Calais.
- (b) Zone 2: All area south of Zone 1 including the US Route 2 and Route 9 boundaries.



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Bituminous plant mix for use other than traveled way wearing course may be placed in either zone between the dates of April 15th and November 15th, provided that the air temperature as determined by an approved thermometer placed in the shade at the paving location is 35 degrees F or higher and the area to be paved is not frozen. Plant mix to be placed as traveled way wearing course may be placed in Zone 1 between the dates of May 1st and the Saturday following October 1st and in Zone 2 between the dates of April 15th and the Saturday following October 15th provided the air temperature determined above is 50 degrees F or higher.

Any hot bituminous base or binder course that is to be subject to traffic during the winter months shall have its gradation densified or asphalt content (percent of mix) adjusted through a change in the job mix formula as submitted by the Contractor and approved by the Owner.

### 3.5 ROLLING AND COMPACTION

- A. The mixture, after being spread, shall be thoroughly compacted by rolling as soon as it will bear the weight of the rollers without undue displacement. Mixture shall be compacted to a minimum, of 92% theoretical maximum density. The number, weight, and types of rollers and sequences of rolling operations shall be such that the required density and surface are consistently attained while the mixture is in a workable condition.
- B. Compact mixture with hot hand tampers or vibrating plate compactors in areas inaccessible to rollers.
- C. Breakdown Rolling: Accomplish breakdown or initial rolling immediately following rolling of joints and outside edge. Check surface after breakdown rolling, and repair displaced areas by loosening and filling, if required, with hot material.
- D. Second Rolling: Follow breakdown rolling as soon as possible, while mixture is hot. Continue second rolling until mixture has been thoroughly compacted.
- E. Finish Rolling: Perform finish rolling while mixture is still warm enough for removal of roller marks. Continue rolling until roller marks are eliminated and course has attained maximum density.
- F. Patching: Remove and replace paving areas mixed with foreign materials and defective areas. Cut out such areas and fill with fresh, hot asphalt concrete. Compact by rolling to maximum surface density and smoothness.
- G. Protection: After final rolling, do not permit vehicular traffic on pavement until it has cooled and hardened. Erect barricades to protect paving from traffic until mixture has cooled enough not to become marked.

### 3.6 FIELD QUALITY CONTROL

- A. An Independent Testing Laboratory, shall be retained to perform construction testing of in-place asphaltic concrete courses for compliance with requirements for thickness, density,

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composition and surface smoothness. Asphaltic surface and asphaltic base/binder courses shall be randomly cored at a minimum rate of one core for every 20,000 square feet of paving. In no event shall less than three cores in light duty areas and three cores in heavy-duty areas shall be obtained. Coring holes shall be immediately filled with full-depth asphalt or with concrete. Asphaltic Concrete pavement samples shall be tested for conformance with the mix design. Refer to the general contract conditions for clarification on the cost for the independent laboratory.

- B. Grade Control: Establish and maintain required lines and elevations.
- C. Thickness: In-place compacted thickness shall not be less than thickness specified on the drawings. Areas of deficient paving thickness shall receive a tack coat and a minimum 1" overlay; or shall be removed and replaced to the proper thickness, at the discretion of the Owner's; until specified thickness of the course is met or exceeded at no additional expense to the Owner.
- D. Surface Smoothness: Testing shall be performed on the finished surface of each asphalt concrete course for smoothness, using 10'-0" straightedge applied parallel with, and at right angles to centerline of paved area. The results of these tests shall be made available to the owner upon request. Surfaces will not be acceptable if exceeding following tolerances for smoothness:

Base Course Surface:	1/4"
Wearing Course Surface:	3/16"

- E. Check surface areas at intervals necessary to eliminate ponding areas. Remove and replace unacceptable paving as directed by Owner.
- F. Compaction: Field density tests for in-place materials shall be performed by examination of field cores in accordance with one of the following standards:
  - 1. Bulk specific gravity of paraffin-coated specimens: ASTM D-1188.
  - 2. Bulk specific gravity using saturated surface-dry specimens: ASTM D-2726.

Rate of testing shall be one core per 20,000 square feet of pavement, with a minimum of 3 cores from heavy-duty areas and 3 cores from standard-duty areas. Cores shall be cut from areas representative of the project.

Areas of insufficient compaction shall be delineated, removed, and replaced in compliance with the specifications at no expense to the Owner.

- G. Pavement Plant Inspection: The paving plant shall be inspected a minimum of one week prior to pavement placement to verify the plant meets the requirements outlined in Section 401. Random inspection and sampling during pavement placement shall be conducted and documented by a testing firm hired and paid for by the Owner.

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- H. After the binder pavement is placed, the Contractor shall retain an independent surveyor to profile the centerline of the access drive at a minimum of 25-foot stations plus survey the elevations at the locations of any pavement spot grades shown on the drawing and all catch basin inlets. This survey information shall be plotted on the drawing access drive profile and a grading plan. The Contractor shall supply this information in triplicate to the Engineer with copies to the Owner, Architect and Construction Manager. A narrative identifying any areas which do not meet the specification tolerances of subsection E of this specification with an outline of corrective measures shall accompany the submission. The Owner shall have four working days upon certified receipt of these data to issue a letter authorizing surface pavement to be placed.

**END OF SECTION**

**SECTION 32 16 15**

**CURBS AND SIDEWALKS**

**PART 1 - GENERAL**

**1.1 SECTION INCLUDES**

- A. Concrete, Brick or Bituminous Sidewalks
- B. Stonedust Walks
- C. Granite Curb
- D. Bituminous Curb
- E. Slipform Cast in Place Concrete Curb (precast concrete curb is not permitted on this project)
- F. Unit Pavers
- G. Tactile Warning Strips
- H. This specification contains the requirements for multiple types of curbing and sidewalks. Some of these will not be required for this project.

**1.2 RELATED SECTIONS**

- A. Section 31 10 00 – Site Clearing
- B. Section 31 20 00 – Earth Moving
- C. Section 32 11 00 – Base Courses
- D. Section 32 12 16 – Asphaltic Paving
- E. State Highway Department Standard Specifications
- F. Construction Documents.

**1.3 SECTION EXCLUDES STRUCTURAL SLABS AT ENTRANCES**

- A. Structural slabs are entryway areas consisting of a slab supported by a foundation contiguous with the building foundation.

**1.4 REFERENCES**

- A. ACI 304 - Recommended Practice for Measuring, Mixing, Transporting and Placing Concrete.

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- B. ANSI/ASTM D1751 - Preformed Expansion Joint Fillers for Concrete Paving and Structural construction.
- C. ANSI/ASTM D1752 - Preformed Sponge Rubber and Cork Expansion Joint Fillers for Concrete Paving and Structural Construction.
- D. ASTM C33 - Concrete Aggregates.
- E. ASTM C94 - Ready Mix Concrete.
- F. ASTM C150 - Portland Cement.
- G. ASTM C260 - Air-Entraining Admixtures for Concrete.
- H. ASTM C309 - Liquid Membrane-Forming Compounds for Curing Concrete.
- I. ASTM C494 - Chemical Admixtures for Concrete.
- J. FA TT-C-800 - Curing Compound, Concrete, for New and Existing Surfaces.
- K. MDOT specifications for Highway and Bridge construction, current edition.
- L. American Society for Testing and Materials (ASTM):
  - 1. C33 – Concrete Aggregates
  - 2. C67 – Standard Test Methods for Sampling and Testing Concrete Masonry Units and Related Units.
  - 3. C144 – Aggregate for Masonry Mortar
  - 4. C936 – Standard Specification for Solid Interlocking Concrete Pavers.
  - 5. C979 – Specification for Pigments for Integrally Colored Concrete.
- M. Interlocking Concrete Pavement Institute (ICPI).
  - 1. Interlocking Concrete Pavement Manual

### 1.5 PERFORMANCE REQUIREMENTS

- A. Contractor shall maintain access for vehicular and pedestrian traffic as required for other construction activities. Utilize temporary striping, flagmen, barricades, warning signs, and warning lights as required.

## PART 2 - PRODUCTS

### 2.1 MATERIALS

- A. Forms: Steel, wood, or other suitable material of size and strength to resist movement during concrete placement and to retain horizontal and vertical alignment until removal. Use straight forms, free of distortion and defects. Use flexible spring steel forms or laminated boards to

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form radius bends as required. Coat forms with non-staining type coating that will not discolor or deface surface of concrete.

- B. Welded Wire Mesh: Welded plain cold-drawn steel wire fabric, ASTM 185. Furnish in flat sheets, not rolls, unless otherwise acceptable to Owner.
- C. Concrete Materials: Comply with requirements of MDOT Specifications Section 502 for concrete materials, admixtures, bonding materials, curing materials, and others as required. Any concrete outside of the building and not a structural slab shall be part of the site work for the project.
- D. Joint Fillers: Resilient pre-molded bituminous impregnated fiberboard units complying with ASTM D 1751 FS HH-F-341, Type II, Class A; or AASHTO M 153, Type I.
- E. Joint Sealers: Non-priming, pourable, self-leveling polyurethane. Acceptable sealants are Sonneborn "Sonolastic Paving Joint Sealant", Sonneborn "Sonomeric CT 1 Sealant", Sonneborn "Sonomeric CT 2 Sealant", Mameco "Vulken 45", or Woodmont Products "Chem-Caulk".
- F. Granite Curb shall be used where required on the Contract Drawings and shall be installed in accordance with the requirements of MDOT Specification 609. All curb shall be of granite mined and cut in the United States of America. Type 1 granite headstones shall be used at all catch basin inlets along the access drive gutter lines. Granite at all ADA ramps shall be Type 1 with a flush reveal. Type V curb is not permitted for tip downs or to directly abut Type 1 curb in any area.
- G. Bituminous Curb shall be used where required on the Contract Drawings and shall be installed in accordance with Section 609 of the MDOT specifications. Fiberglass resin shall be used in all curb. Coatings pursuant to MDOT specifications (seal coat) shall be provided for all bituminous curb.
- H. Slipform Concrete Curb shall be used where required on the Contract Drawings. Concrete materials for Slipform curb will meet the same requirements for concrete curb under 502.05 of the MaineDOT Standard Specifications including 703.0201 associated with ASR Aggregates. This includes a minimum compressive strength of 4000 psi.
- I. Aggregates subbase gravels and base gravels (if appropriate) for sidewalks shall meet the requirements of Section 32 11 00 of these specifications.
- J. Asphaltic concrete pavement for sidewalks shall meet the requirements of Section 32 12 16 of these specifications.
- K. STONEDUST
  - i. 3/8" sieve material as supplied by R. J. Grondin and Sons, Route 25, Gorham, ME 839.5544 or approved equal conforming to the following gradations:

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<u>Sieve Designation</u>	<u>% by Weight Passing Square Mesh Sieves</u>
#6	100
#16	40-63
#40	20-29
#200	0-8

- ii. Construct stone dust on prepared base to lines, grades and sections shown on the drawings and details.
  - iii. Compact to 95% density.
  - iv. During the final grading of lawn areas, bring loam to stone dust walk edges and grades. Create a smooth line where loam meets stone dust. Keep stone dust and loam from becoming mixed.
- L. Aggregate Base: Material for aggregate base course shall be a graded, granular, non-frost susceptible, free-draining material, consisting of either durable stone and coarse sand or of blast furnace slag, practically free from loam and clay, and which can be readily compacted to form a stable foundation.
1. Material shall conform to MDOT Specifications Section 703.06, "Aggregate for Base" Type A gravel.
- M. Unit Pavers:
1. Pedestrian/light traffic clay Pathway paving bricks as manufactured by Pinehall Brick ([www.pinehallbrick.com](http://www.pinehallbrick.com)), or approved equal, and as distributed by Morin Brick (Tel. 207-784-9375 – Jason LaChance).
  2. Unit specifications:
    - a. Unit clay paver shall conform to the requirements of ASTM C902, Class SX, Type 1, Application PX.
    - b. Square, wire-cut edges, no lugs.
    - c. Minimum average compressive strength of 8,500 psi.
    - d. Water absorption less than 6%, without sealer.
    - e. Dimensional tolerance:  $\pm 1/8$ " in any dimension.
    - f. Passes CSA-A231.2 freeze thaw test in saline solution without use of sealers or other products applied to the paver.

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g. Refer to details in the drawings and to the following schedule:

Type/Finish	Size	Uses	Color	Pattern
Pinehall Pathway	4x8x2¼	Sidewalks	Full Range	Runningbond

- i. Color selections correspond to manufacturers’ designations and City of Portland Technical Standards.
- ii. Refer to Enlarged Site Layout Plans for coursing and pattern direction.

3. Detectable Warning Pavers as manufactured by Pavestone, ([www.pavestone.com](http://www.pavestone.com)), Whitacre-Greer ([www.wgpaver.com](http://www.wgpaver.com) or 1-800-947-2837), or approved equal. (N.I.C.)

- a. Dry-press solid (uncored) hard-burned, frost-free pavers with chamfered edge.
- b. Complies with ADA requirements, 5,000 psi min. compressive strength, 8% maximum absorption.
- c. Size: 2 ¼" x 4" x 8".
- d. Color: Light Gray.

4. The pavers shall be free of cracks or other imperfections when viewed from a distance of 20 feet (6 meters). The exposed parts of the brick shall be free of chips exceeding 5/16" from the edge and ½" from a corner. All pavers that do not meet these criteria shall be replaced with acceptable units.

N. Cobblestone (N.I.C.):

- 1. Provide gray granite cobblestones roughly 9"x5"x5" in size.

O. Edge Restraint:

- 1. Provide injection molded polyethylene edge restraint as manufactured by Snap Edge Corporation or approved equal. Use approved edge restraints where a structure, pavement, or curbing does not abut pavers.
- 2. Edge restraint spikes shall be 12" x 3/8" diameter galvanized steel.

P. Setting Bed and Joint Filler:

- 1. Concrete sand conforming to ASTM C33 for bedding sand; ASTM C144 for unit paver joint sand. Bedding sand may be used for unit paver joints, but may require extra sweeping compound and compaction.
  - a. Sand to be sharp, washed and free of foreign material.
- 2. Stone dust may be used instead of sand to fill cobblestone joints.

Q. Bituminous Setting Bed:

- 1. Refer to Section 02525 – Curbs and Sidewalks



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- R. Water: Water shall be potable and shall be free of injurious contaminants.
- S. Catalog cuts and information on the curb supplier shall be submitted to the Engineer for approval prior to ordering the material.
- T. Tactile Warning Strips: Materials shall be selected by the Contractor from the materials shown on the drawings or from materials approved by the City of Portland Technical Standards and shall meet all current ADA standards at the time the materials are ordered.

### 2.2 MIX DESIGN AND TESTING

- A. Design mix to produce normal weight concrete consisting of Portland cement, aggregate, water-reducing admixture, air-entraining admixture, and water to produce the following properties:
  - 1. Compressive Strength: 4,500 psi, minimum at 28 days, unless otherwise indicated on the Drawings.
  - 2. Slump Range: 3"-5" for normal concrete at time of placement
  - 3. Air Entrainment: 4% to 6%

## PART 3 - EXECUTION

### 3.1 PREPARATION FOR SIDEWALKS

- A. Prepare subgrade to receive sidewalk subbase gravel in accordance with Section 32 11 00.
- B. Place and compact subbase and base gravel in accordance with Section 31 20 00 and 32 11 00 of these specifications.
- C. Proof-roll prepared base material surface to check for unstable areas. The paving work shall begin after the unsuitable areas have been corrected and are ready to receive paving. Compaction testing for the base material shall be completed prior to the placement of the paving.
- D. Surface Preparation: Remove loose material from compacted base material surface immediately before placing concrete.

### 3.2 INSTALLATION OF CONCRETE SIDEWALKS

- A. Form Construction:
  - 1. Set forms to required grades and lines, rigidly braced and secured.
  - 2. Install sufficient quantity of forms to allow continuance of work and so that forms remain in place a minimum of 24 hours after concrete placement.

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3. Check completed formwork for grade and alignment to following tolerances:
    - Top of forms not more than 1/8" in 10'-0".
    - Vertical face on longitudinal axis, not more than 1/4" in 10'-0".
  4. Clean forms after each use, and coat with form release agent as often as required to ensure separation from concrete without damage.
- B. Reinforcement: Locate, place and support reinforcement per Division 3 specifications.
- C. Concrete Placement:
1. Comply with requirements of Division 033000 – Concrete.
  2. Do not place concrete until base material and forms have been checked for line and grade. Moisten base material if required to provide uniform dampened condition at time concrete is placed. Concrete shall not be placed around manholes or other structure until they are at the required finish elevation and alignment.
  3. Place concrete using methods which prevent segregation of mix. Consolidate concrete along face of forms and adjacent to transverse joints with internal vibrator. Keep vibrator away from joint assemblies, reinforcement, or side forms. Consolidate with care to prevent dislocation of reinforcing, dowels and joint devices.
  4. Deposit and spread concrete in continuous operation between transverse joints, as far as possible. If interrupted for more than 1/2 hours, place construction joint.
- D. Joint Construction:
1. Contraction Joints: If joints are specified, the curb or gutter shall be constructed in uniform sections of the length specified on the plans. The joints between sections shall be formed either by steel templates 1/8 inch in thickness, or a length equal to the width of the gutter or curb, and with a depth which will penetrate at least 2 inches below the surface of the curb and gutter; or with 3/4 inch thick preformed expansion joint filler cut to the exact cross section of the curb or gutter; or by sawing to a depth of at least 2 inches while the concrete is between 4 to 24 hours old. If steel templates are used, they shall be left in place until the concrete has set sufficiently to hold its shape, but shall be removed while the forms are still in place.
  2. Longitudinal Construction Joints: Concrete curb, concrete gutter, combination concrete curb and gutter, where specified on the plans, shall be tied to concrete pavement with 1/2 inch round, reinforcement bars of the length and spacing shown on the plans.
  3. Transverse Expansion Joints: Transverse expansion joint in curb, curb and gutter, gutter or sidewalk shall have the filler cut to the exact cross section of the curb, curb and gutter, gutter or sidewalk. The joints shall be similar to the type of expansion joint used in the adjacent pavement.

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- E. Joint Fillers: Extend joint fillers full-width and depth of joint, and not less than 1/2" or more than 1" below finished surface where joint sealer is indicated. If not joint sealer, place top of joint filler flush with finished concrete surface. Furnish joint fillers in one-piece lengths for full width being placed, wherever possible. Where more than one length is required, lace or clip joint filler section together.
- F. Joint Sealants: Exterior pavement joint sealants shall be installed per manufacturer's recommendations.
- G. Cold Weather Placing:
  - 1. Protect concrete work from physical damage or reduced strength which could be caused by frost, freezing actions or low temperatures, in compliance with ACI 306 and as specified herein. All expenses associated with the protective measures, temporary heating, etc. shall be at the expense of the Contractor.

When air temperature has fallen to or is expected to fall below 40° F (4° C) uniformly heat water and aggregates before mixing to obtain a concrete mixture temperature of not less than 50° F (10° C) and not more than 80° F (27° C) at point of placement.

Do not use frozen materials or materials containing ice or snow. Do not place concrete or frozen subgrade or subgrade containing frozen materials.

Do not use calcium chloride, salt, and other materials containing antifreeze agents or chemical agents, unless otherwise accepted in mix design.

- H. Concrete Finishing:
  - 1. After striking off and consolidating concrete, smooth surface by screening and floating. Adjust floating to compact surface and produce uniform texture. After floating, test surface for trueness with 10'-0" straightedge. Distribute concrete as required to remove surface irregularities, and refloat repaired areas to provide continuous smooth finish.
  - 2. Work edges of slabs, gutters, back top edge of curb, and formed joints with an edging tool, and round to 1/2" radius. Eliminate tool marks on concrete surface. After completion of floating and troweling when excess moisture or surface sheen has disappeared, complete surface finishing, as follows:
    - a. Inclined Slab Surfaces: Provide coarse, nonslip finish by scoring surface with stiff-bristled broom perpendicular to line of traffic.
    - b. Paving: Provide coarse, nonslip finish by scoring surface with stiff-bristled broom perpendicular to line of traffic.
  - 3. Do not remove forms for 24 hours after concrete has been placed. After form removal, clean ends of joints and point up any minor honeycombed areas. Remove and replace areas or sections with major defects, as directed.

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4. Protect and cure finished concrete paving using acceptable moist-curing methods, more particularly described in the "water-curing" section of ACI 308-81. Apply Saltguard© or approved equal to finished concrete surface.

- I. Cleaning and Adjusting:

1. Sweep concrete pavement and wash free of stains, discolorations, dirt, and other foreign material just prior to final inspection.
2. Protect concrete from damage until acceptance of work. Exclude traffic from pavement for at least 14 days after placement. When construction traffic is permitted, maintain pavement as clean as possible by removing surface stains and spillage of materials.

### 3.4 GRANITE CURB

- A. Granite curbing will be installed and backfilled in accordance with provisions of Paragraph 3.06. If Type 5 sloped curb configuration is used, the curb shall be set on a slope as shown on the plans. All granite curb used to form a radius and any granite curb of any type with stone length of less than 36" shall be backfilled with lean concrete to a level equal to the binder pavement surface in front of the curb and a level equal to 3" below finish grade behind the curb.
- B. Protect the granite curb from damage throughout construction and until substantial completion.

### 3.5 BITUMINOUS CURB

- A. Bituminous curb shall be installed on the bituminous pavement base course prior to placement of final bituminous pavement wearing course. The curb shall be backfilled with approved materials. That shall be placed in layers not exceeding 8 inches in depth, loose measure and thoroughly tamped.
- B. Bituminous curb shall be seal coated after placement in accordance with MDOT Standard Highway specifications.

### 3.6 SLIPFORM CONCRETE CURB

- A. Installation: Concrete may be placed with an approved Slipform machine that will produce a finished product according to the design specified in the plans and will meet the same standards set for cast-in-place curbing. For cold weather slipforming, the outside temperature must be at least 36 °F (2.2 °C) and rising. The curb shall be placed on a firm, uniform bearing surface, shall conform to the section profile specified in the plans and shall match the appropriate grade. Proper curing shall be insured through the use of a curing compound spray that meets ASTM specifications. Expansion joints will be provided at ends of curve radii or wherever the curb meets rigid structures such as building foundations or fire hydrants. Contraction joints will be placed at 10 foot (3 m) intervals using sawing methods, which cut 1-3" into the concrete. Joints shall be constructed perpendicular to the subgrade and match other joints in roadways, sidewalks or other structures when applicable. If the concrete is placed on bituminous pavement, an approved epoxy or adhesive shall be used to bond the curb to the pavement. The

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contractor shall form tip downs and transitions to conform to the requirements of the construction documents and details.

- B. Backfilling: Same as Section 609.05 (B) of the Maine Department of Transportation Standard Specifications.
- C. Protection: Slipform curbing must be adequately protected after placement. The concrete shall be allowed to cure for at least 72 hours. During cold weather conditions, when temperatures drop below the required temperature of 36 °F (2.2 °C) after placement, curbing shall be protected by concrete blankets or a combination of plastic sheeting and straw. After any placement of Slipform curbing, regardless of weather conditions, the placed curbing shall be adequately protected by traffic control devices and flagging as necessary

### 3.6 HOT BITUMINOUS CONCRETE SIDEWALKS

- A. Bituminous concrete pavement for sidewalks shall be placed in two lifts to provide the total thickness specified on the drawings.
- B. Compaction shall be by a paver roller having a minimum total weight of 2,000 lb. with a minimum of 65 lbs. per inch of drive roll or by satisfactory vibratory equipment.
- C. Placement and quality control shall comply with Section 32 12 16 of these specifications.

### 3.7 BRICK SIDEWALKS

- A. Preparation: Provide and compact base gravel where required as surface to place stone dust or bituminous concrete as shown on the detail.
- B. Stone Dust: A layer of sand cement base material one (1") inch thick shall be spread upon the properly prepared bituminous concrete base. This course of stone dust shall be firm but not compacted.
- C. Brick Placement: Perform all masonry work with skilled workmen under adequate supervision. A journeyman brick mason shall supervise all brick placement. Lay all masonry true to lines and grade with all surfaces true, and corners straight and plumb. Lay exposed-to-view bricks smooth side up, with an individual unit-to-unit level tolerance not to exceed 1/8-inch and an overall tolerance from the grade not to exceed ¼-inch in 10 feet in any direction. Lay no unit having chipped edges of face, in exposed-to-view locations. Remove any such unit, if installed and replace with a new undamaged unit.
  - 1. Brick Laying: The brick shall be laid in patterns shown on the drawings. The joints shall be hand tight, leaving only as much space between bricks as occurs naturally from rough surface or slight irregularities. When necessary, the brick shall be cut with a masonry saw. The Owner will require replacement of improperly broken bricks. No struck brick shall be less than two (2') inches in length.
- D. Compaction: After the bricks are carefully laid upon the properly prepared sand cement base, a 2" x 4" board shall be placed upon the bricks and shall be tapped with a hammer until the bricks reach a firm, unyielding bed and present a surface of the proper grade and slope. Any

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divergence from line and grade is to be corrected by taking up and relaying the bricks. After setting the bricks, a sufficient amount of sand cement shall be spread over the surface and thoroughly swept or raked so as to fill the joints. All surplus sand cement remaining on the brick paved areas after the joints have been properly filled shall be removed by sweeping. Avoid raking out the joints during the removal of excess sand cement.

- E. Moisture: Sufficient moisture shall be applied by sprinkling to permit the sand cement to achieve and set.
- F. After 3 days, the surface of the walk shall be cleaned with a solution of muriatic acid to remove any cement film.

### 3.8 INSTALLATION OF UNIT PAVERS (N.I.C.)

#### A. Base:

1. Contractor shall inspect and verify that aggregate base and bituminous binder course or concrete frost slab for all work covered in this Section have been placed and compacted in the amounts specified in the Drawings and Specifications (See Section 02200 - Earthwork and Section 02511 – Asphaltic Concrete Paving).
2. Commencement of work by the Contractor signifies acceptance of base conditions. Any deviations or abnormalities in base preparation are to be reported to the owner's representative immediately.

#### B. Edge Restraint:

1. Place edge restraint to exact lines as shown on drawings.
2. Straight runs to be true to the line, and curves to be smooth and true to form.
3. Install edge as per manufacturer's specifications. Top edge should not be visible from surface.
4. Notify Owner's representative after edge installation and before setting of pavers.

#### C. Sand Setting Bed:

1. Place and screed sand to grades and lines as required. Thickness after paver installation to be no less than 1" and no greater than 1 1/2".
2. Do not use water-saturated or frozen sand.
3. Do not use sand to compensate for improperly installed or compacted base or for making up any unevenness or irregularity in the base course surface as this will show through to the finished surface of the pavers over time.
4. Do not walk on or otherwise disturb screeded setting bed surface prior to paver installation.

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### D. Pavers:

1. Set pavers hand tight using specified colors, shapes and textures in patterns and configurations shown.
2. Trim and cut pavers as required using a motor driven masonry saw with a blade designed specifically for the cutting of paving units. Keep cuts to a minimum. Small pieces less than 2" in any dimension, or pieced together to create a larger "whole" will not be accepted.
3. A typical spacing of 1/16" is to be maintained between pavers; maximum joint width 1/8".
4. Gaps between pavers and adjoining objects of greater than 3/8" shall be filled with sand.
5. After pavers are set, vibrate into place with a plate vibrator capable of 3,000 to 5,000 pounds centrifugal compaction force and operating at a frequency of 80 to 90 hertz. Two passes in opposing directions (at right angles) minimum to be made with vibrator.
6. Sweep joints with dry sand, and vibrate (lightly water when sand/cement used). Repeat process to fill joints. Damp sand may be spread over paver surface and allowed to dry before filling joints.
7. Do not compact closer than 3' to an unrestrained paver edge.
8. All work must be compacted up to 3' from stopping point by the end of each workday. Cover and protect setting bed and uncompacted pavers until resumption of work.

### E. Expansion and Control Joints:

1. Provide for sealant-filled joints at building foundation and against concrete slabs or foundations.
2. Provide compressible form filler as backing for sealant-filled joints as necessary.
3. Install joint filler before setting pavers.
4. Make top of joint filler flush with top of pavers.

### F. Tolerances:

1. Do not exceed 1/16-inch (1.6 mm) unit-to-unit offset from flush (lippage) nor 1/8 inch in 24 inches (3 mm in 600 mm) and ¼ inch in 10 feet (6 mm in 3 m) from level, or indicated slope, for finished surface paving.
2. Surface elevation of pavers are to be 1/8" to 1/4" above adjoining curbs, inlets, walks, etc. (and may be 1/8" to 1/4" above final grades in general) to allow for characteristic minor settling.

### G. Repair, Protection, Cleanup:

1. Replace units that are chipped, broken, stained, or in any other way do not conform to or may adversely affect the adjoining work.
2. Work area to be left in a neat and orderly manner upon completion of work, free from debris and swept clean.

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3. Finished work is not to be used for storage of materials, unapproved vehicle movement or other operations which may damage, stain or otherwise mar the paver surface.

### **H. Inspection and Acceptance:**

1. When paver installation is complete, the owner's representative will, upon request, inspect work to determine acceptability.
2. Work that does not comply with requirements will be removed and replaced as specified and as shown on drawings, at no additional cost to Owner.
3. The owner's representative will, upon completion and request, inspect replaced areas to determine acceptability.

**END OF SECTION**



**SECTION 32 17 23.13**

**PAINTED PAVEMENT MARKINGS**

**PART 1 - GENERAL**

**1.1 SECTION INCLUDES:**

- A. The work shall consist of furnishing and placing permanent reflectorized pavement markings as shown on the plans or as designated by the Engineer.
- B. When it is necessary to remove existing pavement lines or markings, it shall be done by grinding, sand blasting, or other acceptable method. The method chosen must be capable of completely eradicating the existing lines or markings without damage to the existing pavement.

**1.2 RELATED REQUIREMENTS:**

- A. Section 31 20 00 – Earth Moving
- B. Section 32 11 00 – Base Courses
- C. Section 32 12 16 – Asphaltic Paving
- D. Construction Drawings

**1.3 PROJECT CONDITIONS**

- A. Maintain access for vehicular and pedestrian traffic as required for other construction activities. Utilize flagmen, barricades, warning signs and warning lights as required.

**PART 2 - PRODUCTS**

**2.1 MATERIALS**

- A. The paint shall be a non-bleeding, quick-drying, alkyd petroleum base paint suitable for traffic-bearing surfaces and shall meet FS TTP-85E and mixed in accordance with manufacturer's instructions before application.

**PART 3 - EXECUTION**

**3.1 SITE MEETING**

- A. A site meeting including the Engineer, Contractor, Pavement Marking Subcontractor, and the Owner shall be conducted prior to conducting the work. Marking locations, colors for the markup, and dates of application shall be confirmed at this meeting. The Owner reserves the right to alter or modify said locations at this meeting.

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### 3.2 PREPARATION

- A. Sweep and clean surface to eliminate loose material and dust.
- B. Where existing pavement markings are indicated on the drawings to be removed or would interfere with the adhesion of new paint, a motorized device shall be used to remove the markings. The equipment employed shall not damage the existing paving or create a surface hazardous to vehicle or pedestrian traffic. In all areas within public rights-of-way, the method of marking removal shall be approved by governing authority.

### 3.3 APPLICATION

- A. Apply two (2) applications of paint at manufacturer's recommended rate without the addition of thinner, with a maximum of 125 square feet per gallon. Install during calm (low wind) conditions in order that spray or unintended paint does not affect adjacent areas. Where necessary, apply during periods of the day when traffic can be controlled and barricaded from area where markings are being installed. Use proper barricades, traffic and safety officers. Apply with mechanical equipment to produce uniform straight edges. At sidewalk curbs and crosswalks, use a straightedge to ensure a uniform, clean, and straight stripe. A minimum of 48 hours shall elapse between the applications.
- B. The following items are to be painted with the colors noted below:
  - 1. Pedestrian Crosswalks: White
  - 2. Lane Striping where separating traffic in opposite directions: Yellow
  - 3. Lane Striping where separating traffic in same direction: White
  - 4. Handicap Symbols: Conforming to the modified symbol for International Barrier Free as shown on drawings
  - 5. Parking Stall Striping: White
  - 6. Parking space numbering (if required by plans): White
  - 7. Stop Bars: Provide painted stop bars where shown on the plan
  - 8. Directional Arrows: White
  - 9. Fire Lane: Per Fire Department and Portland Public Works selection
  - 10. Chevrons: Yellow

**END OF SECTION**

SECTION 32 30 00

SITE IMPROVEMENTS

**PART 1 - GENERAL**

1.1 GENERAL PROVISIONS

- A. The CONDITIONS OF THE CONTRACT and all Sections of Division 1 are hereby made a part of this Section.

1.2 SECTION INCLUDES

- A. Divisions 01 through 33 Sections for requirements specific to the work of each of these Sections. Requirements may or may not include reference to LEED.
- B. Work Included: Provide labor, materials and equipment necessary to complete the work of this Section, and without limiting the generality thereof furnish and install the following:
  - 1. Bicycle Rack
  - 2. Benches

1.3. RELATED SECTIONS

- A. Section 03 30 00 – Cast-In-Place Concrete.
- B. Section 31 20 00 – Earth Moving.
- C. Section 32 93 00 – Trees, Plants and Ground Covers.

1.4 QUALITY ASSURANCE; SUBMITTALS

- A. Quality Assurance: Conform to requirements of Section 01 33 00 – Submittal Procedures.
- B. Submittals: Provide as follows:
  - 1. Product Data:
    - a. All manufactured equipment.
    - b. Metal fasteners, anchors, other accessories.
- C. Shop Drawings: All items where installation methods are not fully described in product data. Where appropriate, and when approved by the Engineer, manufacturer's catalogue cuts may be substituted for shop drawings.

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### 1.5 REFERENCE STANDARDS

- A. Comply with applicable requirements of the following standards. Where these standards conflict with other specified requirements, the most restrictive requirements shall govern.
  - 1. American Society for Testing and Materials (ASTM):
    - A 153 Zinc Coating (Hot-Dip) on Iron and Steel Hardware
- B. MDOT: Where specified, comply with applicable provision of State of Maine Department of Transportation Standard Specifications for Highways and Bridges, hereinafter referred to as MDOT.
- C. Earthwork: Conform to requirements of Section 31 20 00 – Earth Moving.

## PART 2 - PRODUCTS

### 2.1 PRODUCTS

- A. Products: Supply and install the following:
  - 1. Bicycle Racks: Galvanized steel, in-ground mounted Bike Hitch, as manufactured by Dero ([www.dero.com](http://www.dero.com), 800-298-4915), or approved equal. Quantity: 11 Hitches.
  - 2. Benches (N.I.C.):
    - a. Products as manufactured by Victor Stanley, Inc. ([www.victorstanley.com](http://www.victorstanley.com), 301-855-8300); Urbanscape ([www.urbanscapefurniture.com](http://www.urbanscapefurniture.com) 1-866-903-3714), or approved equivalent. Black powder coat finish, with wheat or maple recycled plastic slats. Quantities as indicated in the Drawings.
    - b. 7 foot bench without back or arms; faux-wood (wheat); in-ground mount; Urbanscape Kentland Collection #24 KE14221.
    - c. 4 foot bench with back and arms and recycled plastic slat seat; Victor Stanley, GreenSites Series Model CM-50. Maple slats.
    - d. Benches shall be bolted to concrete pads, in accordance with the details.
  - 3. Bench Alternate (for 7-foot bench) (N.I.C.):
    - a. 6 foot bench without back or arms: Victor Stanley GreenSites Series Model CM-53, recycled plastic slat; color: Maple; tubular steel frames with black powder coat finish. In-ground mounted in 12" diameter x 2-foot deep foundations.
  - 4. PVC Solid Waste Enclosure and Fence (N.I.C.):
    - a. Provide as indicated, conforming to manufacturer's specifications. This work shall include the supply and installation of all PVC fence including posts, gates, fasteners, finishes and ancillary equipment as depicted on the contract drawings or as required to render the installation complete.

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- b. Acceptable manufacturers include BuffTech by CertainTeed Corporation as distributed by Gorham Fence Co. or equal.
  - c. All corner and end posts of trash enclosures shall have Schedule 40 galvanized steel inserts. All gate hardware (hinges, latches, handles & pins) shall be galvanized steel.
  - d. Set all posts in 12" dia. Sonotube filled with concrete.
5. Steel Fencing and Gates (N.I.C.):
- a. Fusion-welded steel ornamental fence, Montage II, heavy industrial weight, as manufactured by Ameristar Fence Products ([www.ameristarfence.com](http://www.ameristarfence.com) or 1-800-321-8724).
    - 1. Posts: 2 ½" square, up to and including 6' height, 3" square minimum over 6' height.
    - 2. Pickets: 1" square.
    - 3. Color: Black
  - b. Security fencing and gates shall be Invincible, Style I3 (3-rail). (Type A).
    - 1. Refer to drawings and details for gates and panel dimensions and locations.
  - c. Ornamental fencing, railing and gates (Type B), shall be Majestic Series Style M3, (3-rail).
    - 1. Refer to drawings and details for gates and panel dimensions and locations.

## PART 3 – WARRANTIES

### 3.1 GENERAL

- A. The supplier shall provide warranties on all materials and workmanship for one year excluding vandalism.
- B. Site Contractor shall guarantee concrete for one year excluding vandalism.

**END OF SECTION**

SECTION 32 40 00

SIGNAGE

PART 1 - GENERAL

1.1 SUMMARY

- A. Provide traffic control signs complying with U.S. Department of Transportation, Federal Highway Administration's "Manual on Uniform on Traffic Control Devices", local codes, and as specified. See Drawings for type, location, and quantity of signs required.
- B. Related Sections:
  - 1. Construction Drawings.
  - 2. Manufacturer's Mounting Instructions.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURER

- A. Signs to meet FHWA requirements NCHRP 350 certification, engineer grade reflective.
- B. Provide information for all signs, proposed mounting heights, mounting hardware, and posts to be submitted to the Owner for review and approval prior to installation.
- C. Posts to be 2" diameter galvanized steel tube.

2.2 MATERIALS

- 1. To be backed with Alucobond panels, to be tan or light grey or selected by the Owner. To be painted with reflective baked-enamel finish with following colors:
- 2. "STOP" Signs: (R1-1) 24"x24", Octagon, reflectorized copy and border.
- 3. "MODIFIED HANDICAPPED SYMBOL" Signs per size shown on the contract drawing, white legend on blue background. Handicapped van accessible sign shall be the dimensions shown on the contract drawings.
- 4. "DO NOT ENTER" Signs: (R5-1) Highway Dept. standard red and white sign except 24"x24" size.
- 5. Miscellaneous Signs: Per Manual on Uniform Traffic Control Device recommendations or lettered with dimensions shown on the contract drawings.

2.3 POSTS

- A. Posts shall be 2" diameter galvanized steel tube with galvanized steel weather tight closure cap.

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### **PART 3 - EXECUTION**

- A. Conduct an on-site meeting with the Engineer and Owner prior to start of the work to review/confirm sign location and types.
- B. Red signs shall be on top where multiple signs are on a single post, larger signs shall be installed above smaller signs.
- C. Install weed control collar when signs are installed in turf areas.
- D. All signs in pedestrian areas shall be mounted with the bottom of the sign at 7' above finish grade. Signs in non-pedestrian areas shall be mounted with the bottom of the sign at 5' above finish grade except ADA signs which shall be 7'. Set posts vertical and plumb as shown in the plans. Mount signs in accordance with manufacturer's instructions. Check mounting height, replace any posts which are not installed plumb.

**END OF SECTION**

SECTION 32 92 00

TURF AND GRASSES

PART 1 – GENERAL

1.1 WORK INCLUDED

- A. Provide all materials and equipment, and do all work required to complete the loaming, seeding and sodding including furnishings and placing topsoil, as indicated on the Drawings and as specified.

1.2 SECTION INCLUDES

- A. Divisions 01 through 33 Sections for requirements specific to the work of each of these Sections.

1.3 RELATED WORK

- A. Examine Contract Documents for requirements that affect work of this Section. Other Specification Sections that directly relate to work of this Section include, but are not limited to:
  - 1. Section 31 20 00 – Earth Moving - Establishment of subgrade elevation.
  - 2. Section 31 25 13 – Erosion Controls - Soil stabilization measures.
  - 3. Section 32 93 00 – Trees, Plants, and Ground Covers - Landscaping.

1.4 REFERENCES

- A. Comply with applicable requirements of the following standards. Where these standards conflict with other specified requirements, the most restrictive requirements shall govern.
  - 1. American Society for Testing and Materials (ASTM)
    - C 136 Sieve Analysis of Fine and Coarse Aggregates
    - E 11 Wire-Cloth Sieves for Testing Purposes

1.5 SUBMITTALS

- A. Submit under provision of Division 1.
- B. Product Data: Provide for each product specified herein.



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C. Samples: The following samples shall be submitted:

<u>Material</u>	<u>Quantity (lb.)</u>
Topsoil	1
Fertilizer	1

D. Manufacturer's Product Data: Manufacturer's product data shall be submitted for the following materials if to be used on the project:

Aluminum sulfate  
Fertilizer  
Lime

E. Certificates: Labels from the manufacturer's container certifying that the product meets the specified requirements shall be submitted for the following materials:

Grass seed mix (each)	Commercial fertilizer
Ground limestone	Seed mix for sod

F. Gradation and laboratory analysis:

Topsoil without Admixture  
Topsoil with Admixtures

**1.6 INSPECTION AND TESTING**

A. Work will be subject to inspection at all times by the Engineer/Landscape Architect. The Owner reserves the right to engage an independent testing laboratory in accordance with the requirements of Section 01 45 00 QUALITY CONTROL, to analyze and test materials used in the construction of the work. Where directed by the Engineer/Landscape Architect the testing laboratory will make material analyses and will report to the Engineer/Landscape Architect whether material conform to the requirements of this specification.

1. Cost of tests and material analyses made by the testing laboratory will be borne by the Owner when they indicate compliance with the specification, and by the Contractor when they indicate non-compliance.
2. Testing equipment will be provided by and tests performed by the testing laboratory. Upon request by the Engineer/Landscape Architect, the Contractor shall provide such auxiliary personnel and services needed to accomplish the testing work and to repair damage caused thereto by the permanent work.
3. Gradation of granular materials shall be determined in accordance with ASTM C 136. Sieves for determining material gradation shall be as described in ASTM E 11.

B. Testing, analyses, and inspection required by the Contractor for his own information or guidance shall be at his own expense.

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- C. The Contractor shall engage an independent testing agency to perform the following tests and analyses:

<u>Material</u>	<u>Tests and Analysis Required</u>
Topsoil	Mechanical analysis of soil and determination of pH and organic matter content, and nutrient content. Recommendations shall be made by the testing agency as to the type and quantity of soil additives required to bring nutrient content and pH to satisfactory levels for seeding and sodding. Organic admixtures shall be provided and blended to provide an average organic content of 8% with a minimum of any test having 6% organic content by dry weight.

1. Materials shall not be used in construction until the Engineer/Landscape Architect has reviewed test results.
2. All costs associated with testing shall be at the expense of the Contractor.

### 1.7 DELIVERY, STORAGE, AND HANDLING

A. Digging Sod:

1. Sod shall not be dug at the nursery or approved source until ready to transport sod to the site of the work or acceptable storage location.
2. Before stripping, sod shall be mowed at a uniform height of 2 in.
3. Cut sod to specified and to standard width and length desired.

B. Transportation of Sod:

1. Sod transported to the Project in open vehicles shall be covered with tarpaulins or other suitable covers securely fastened to the body of the vehicle to prevent injury. Closed vehicles shall be adequately ventilated to prevent overheating of the sod.
2. Evidence of inadequate protection following the digging, carelessness while in transit, or improper handling or storage, shall be cause for rejection.
3. Sod shall be kept moist, fresh, and protected at all times. Such protection shall encompass the entire period during which the sod is in transit, being handled, or is in temporary storage.
4. Upon arrival at the temporary storage location or the site of the work, sod material shall be inspected for proper shipping procedures. Should the sod be dried out, the Engineer/Landscape Architect will reject the sod. When sod has been rejected, the Contractor shall at once remove it from the area of the work and replace it with acceptable material.

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5. Unless otherwise authorized by the Engineer/Landscape Architect, the Contractor shall notify the Engineer/Landscape Architect at least two working days in advance of the anticipated delivery date of sod material. Certificate of Inspection when required shall accompany each shipment.
- C. Handling and Storage of Sod:
1. Sod material shall be handled with extreme care to avoid breaking or tearing strips.
  2. Sod shall not be stored for longer than 30 hours prior to installation. Sod shall be stored in a compact group and shall be kept moist. Sod shall be prevented from freezing.
  3. Sod that has been damaged by poor handling or improper storage will be rejected by the Engineer/Landscape Architect.
- D. Deliver seed in original sealed containers, labeled with analysis of seed mixture, percentage of pure seed, year of production, net weight, date of packaging, location of packaging, and name of seed grower. Damaged packages will not be accepted.
- E. Deliver fertilizer in sealed waterproof bags, printed with manufacturer's name, weight, and guaranteed analysis.

### 1.8 PLANTING SEASON

- A. Planting season for seeding shall be as follows:

<u>Item</u>	<u>Planting Period</u>	
	<u>Spring</u>	<u>Fall</u>
Grass Seed Mixes	4/15 to 6/15	8/15 to 10/15

- B. Planting season for sod shall be as follows:

<u>Item</u>	<u>Planting Period</u>	
	<u>Spring</u>	<u>Fall</u>
Sod	4/15 to 7/1	8/15 to 11/1

- C. Planting shall only be performed when weather and soil conditions are suitable for planting the material specified in accordance with locally accepted practice.
- D. Planting season may be extended with the written permission of the Engineer/Landscape Architect.

### 1.9 ACCEPTANCE

- A. Acceptance:

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1. The Engineer/Landscape Architect will inspect all work for Substantial Completion upon written request of the Contractor. The request shall be received at least ten calendar days before the anticipated date of inspection.
  2. Acceptance of material by the Engineer/Landscape Architect will be for general conformance to specified requirements, and shall not relieve the Contractor of responsibility for full conformance to the Contract Documents.
  3. Upon completion and re-inspection of all repairs or renewals necessary in the judgment of the Engineer/Landscape Architect, the Engineer/Landscape Architect will recommend to the Owner that the work of this Section be accepted.
- B. Sod and seed areas will be accepted when in compliance with all the following conditions:
1. Roots are thoroughly knit to the soil;
  2. Absence of visible joints (sodded areas);
  3. All areas show a uniform stand of specified grass in healthy condition, free of weeds, individual bare spots of over 72 square inches or multiple bare spots in excess of 1 percent of the area.
  4. At least 60 days have elapsed since the completion of work under this Section.

## PART 2 – PRODUCTS

### 2.1 SEED

- A. Seed shall be of the previous year's crop with 0.5% or less weed seed, and 1.75% or less crop seed, by weight. Seed shall be dry and free of mold. Seed shall meet the following requirements.
- B. Seed Mixture:
1. Standard grade seed of the most recent season's crop. Seed shall be dry and free of mold.
  2. Seed mixture shall be suitable as follows:

Name of Seed	% by Weight in Mixture	Minimum % Purity	Minimum % Germination
<b>Lawn Areas</b>			
Tall Fescue	40%	95%	85%
Imp. Perennial Ryegrass	35%	95%	85%
Kentucky Bluegrass	25%	95%	85%

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Name of Seed	% by Weight in Mixture	Minimum % Purity	Minimum % Germination
<b>Erosion Control – NE Erosion Control Mix – on slopes</b>			
New England Erosion Control Mix as manufactured by New England Wetland Plants, Inc. – Amherst, MA			
<b>Low Maintenance Areas – NE Conservation/Wildlife Mix</b>			
New England Conservation/Wildlife Mix as manufactured by New England Wetland Plants, Inc. – Amherst, MA			
<b>Pearl’s Ultra Low Maintenance Areas – infrequent mowing</b>			
Pearl’s Premium Ultra Low Maintenance Lawns – Sunny Mix as manufactured by Pearl’s Premium (www.PearlsPremium.com)			
<b>Temporary Seeding Plan</b>			
Perennial Ryegrass	50%	95%	85%
Annual Ryegrass	50%	95%	85%

2.2 SOD

- A. Sod shall be a triplex mixture of hybrid bluegrass. Mixture shall contain approximately equal portions of each hybrid component. Hybrids shall include Cheri Kentucky Bluegrass, Flying Kentucky Bluegrass, Glade Kentucky Bluegrass, Baron Kentucky Bluegrass, or comparable equal bluegrass hybrids.
- B. Sod shall be nursery grown on cultivated mineral agricultural soils. Sod shall have been mowed regularly and carefully, and otherwise maintained from planting to harvest.
- C. Thickness of Cut: Sod shall be machine cut at a uniform soil thickness of 5/8 in., plus or minus ¼ in., at the time of cutting. Measurement for thickness shall exclude top growth and thatch.
- D. Strip Size: Individual pieces of sod shall be cut to the supplier’s standards width and length. Maximum allowable deviation from standard widths and lengths shall be plus or minus ½ in. on width, and plus or minus 5% on length. Broken strips and torn and uneven ends will not be acceptable.
- E. Strength of Sod Strips: Standard size sections of sod shall be strong enough to support their own weight and retain their size and shape if suspended vertically when grasped in the upper 10% of the section.
- F. Moisture Content: Sod shall not be harvested or transplanted when moisture content (excessively dry or wet) may adversely affect its survival.
- G. Time Limitations: Sod shall be harvested, delivered, and transplanted within a 36-hour period unless a suitable preservation method is approved prior to delivery. Sod not transplanted within this period shall be inspected and approved by the Engineer/Landscape Architect prior to its installation.

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- H. Thatch: Sod shall be free of diseases, nematodes, and soil-borne insects. State Nursery and Plant Material Laws require that all sod be inspected and approved for sale. The inspection and approval must be made by the State Agricultural Department, Office of the State Entomologist.
- I. Diseases, Nematodes, and Insects: Sod shall be free of diseases, nematodes, and soil-borne insects. State Nursery and Plant Material Laws require that all sod be inspected and approved for sale. The inspection and approval must be made by the State Agricultural Department, Office of the State Entomologist.
- J. Weeds: Sod shall be free of objectionable grassy and broad leaf weeds.

### 2.3 TOPSOIL

- A. Topsoil shall be obtained from a previously established stockpile on the site, to the extent available. Additional topsoil required shall be obtained from off-site sources.
- B. Topsoil, whether stripped from site or supplied from off-site, shall be a sandy loam or loam soil as defined by the USDA Soil Conservation Service, Soil Classification System, and shall have the following mechanical analysis:

Textural Class	% of Total Weight	Average %
Sand (0.05-2.0 mm dia. range)	45 to 75	60
Silt (0.002-0.05 mm dia. range)	15 to 35	25
Clay (less than 0.002 m dia. range)	5 to 25	15

- 1. 95% of topsoil shall pass a 2.0 mm sieve.
  - 2. Topsoil shall be free of stones 1 in. in longest dimension, earth clods, plant parts, and debris. All topsoil shall be screened using a 3/8" screen.
  - 3. Organic matter content shall be an average of 8% of total dry weight with a minimum of any sample being 6%.
- C. Topsoil shall have a pH value range of 6.0 to 6.5.
    - 1. If planting soil mixture does not fall within the required pH range, limestone or aluminum sulfate shall be added to bring the pH within the specified limit.
    - 2. If pH is below desired level add ground limestone. If pH is above desired level add aluminum sulfate.

### 2.4 LIMESTONE

- A. Ground limestone shall be an agricultural limestone containing a minimum of 85% total carbonates, by weight. Ground limestone shall be graded within the following limits:

Sieve Size                      % Passing by Weight

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No. 10	100
No. 20	90
No. 100	60

### 2.5 WATER

- A. Water shall be suitable for irrigation and free from ingredients harmful to seeded or sodded areas.

### 2.6 ALUMINUM SULFATE

- A. Aluminum sulfate shall be unadulterated and shall be delivered in containers with the name of the material and manufacturer, and net weight of contents.

### 2.7 COMMERCIAL FERTILIZER

- A. Fertilizer shall conform to the following:

1. When applied as a topsoil amendment, fertilizer shall have an analysis that will deliver appropriate amounts of nitrogen, phosphorus, and potassium as required to remedy deficiencies revealed by testing the topsoil.
2. When used as a top dressing for the maintenance of sod, fertilizer shall conform to the following:

<u>Constituent</u>	<u>% Present by Weight</u>
Nitrogen (N)	10
Phosphorous (P)	0
Potassium (K)	20

- a. 50% of nitrogen shall be derived from natural organic source of ureaform. Organic and/or slow release forms of Nitrogen are preferred.
  - b. Recommended fertilizer shall contain zero phosphorus with a nutrient analysis most suitable for supplying test indicated amounts of Nitrogen and Potassium.
  - c. Potassium shall be derived from muriate of potash containing 60% potash.
- B. Fertilizer shall be delivered in manufacturer's standard container printed with manufacturer's name, material weight, and guaranteed analysis.
- C. Fertilizers with N-P-K analysis other than that stated above may be used provided that the application rate per square foot of nitrogen, phosphorus, and potassium is equivalent.

### 2.8 MULCHES

- A. Straw Mulch: Air-dried, clean, mildew- and seed-free, salt hay or threshed straw of wheat, rye, oats, or barley.

### 2.9 PESTICIDES, FUNGICIDES

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- A. General: Pesticide or fungicide registered and approved by EPA, acceptable to authorities having jurisdiction, and of type recommended by manufacturer for each specific problem and as required for Project conditions and application. Restricted pesticides or fungicides shall not be used unless authorized in writing by authorities having jurisdiction.

### PART 3 – EXECUTION

#### 3.1 PREPARATION OF SUBGRADE

- A. Subgrade shall be examined to ensure that rough grading and all other subsurface work in lawn areas and other areas to be seeded is done prior to start of seeding and sodding.
- B. Existing subgrade shall be loosened or scarified to a minimum depth of 3 in. prior to spreading topsoil. Subgrade shall be brought to true and uniform grade, and shall be cleared of stones greater than 2 in., sticks, and other extraneous material.

#### 3.2 PREPARATION OF TOPSOIL

- A. Topsoil shall not be spread until it is possible to follow immediately or within 24 hours with seeding or sodding operations. If topsoil is spread prior to this time it shall be cultivated to loosen soil prior to seeding or sodding.
- B. Topsoil shall not be placed when subgrade or topsoil material are frozen, excessively wet, or excessively dry.
- C. Topsoil shall be spread in a uniform layer, to a thickness, which will compact to the depth required to bring final lawn and grass surfaces to required elevation. Unless otherwise indicated minimum depth of topsoil shall be 6 in. after compaction.
- D. Surfaces shall be graded and smoothed, eliminating all sharp breaks by rounding, scraping off bumps and ridges, and filling in holes and cuts.

#### 3.3 APPLICATION OF FERTILIZER AND CONDITIONERS

- A. Fertilizer and conditioners shall be applied at the following rates:
  - 1. Aluminum Sulfate – as required by test results of topsoil.
  - 2. Limestone - as required by test results of topsoil.
  - 3. Fertilizer - as required by test results of topsoil.  
Suggested rate: 1 pound active Nitrogen per 1000 square feet.
- B. For maintenance of lawn grasses, fertilizer shall be applied at 1 pound active Nitrogen per 1000 square feet. Application frequency: 3 times per year. Apply lime as determined by annual soil tests.



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- C. Mixing with topsoil:
  - 1. Fertilizer and conditioners shall be spread (and adjust fertilizer frequency requirements) over the entire areas designated at the application rates indicated above.
  - 2. Materials shall be uniformly and thoroughly mixed into the top 4 in. of topsoil by disking, rototilling, or other approved method.

### 3.4 FINISH GRADING

- A. Final surface of topsoil immediately before seeding shall be within  $\pm 1/2$  in. of required elevation, with no ruts, mounds, ridges, or other faults, and no pockets or low spots in which water can collect. Stones, roots, and other debris greater than 1 in. in any dimension, which are visible at the surface, shall be removed and the resulting holes filled with topsoil, leaving a uniform planar surface.
- B. Finish grade surface with a drag or rake. Round out all breaks in grade, smooth down all lumps and ridges, fill in all holes and crevices. Rolling with a light roller is acceptable, if the surface is scarified afterward.
- C. In the event of settlement, the Contractor shall readjust the work to required finished grade.

### 3.5 SEED APPLICATION

- A. Seed shall be broadcast by means of an approved mechanical slice seeder, to give a uniform application at the following rates:

<u>Seed Mix Rate</u>	<u>Application Rate</u> <u>lb./1,000 S.F.</u>
Lawn	8.00
Erosion Control Mix	1.00
Conservation/Wildlife Mix (Low Maint. Areas)	0.75
Pearls Ultra Low Maintenance-Sunny Mix	7.00
Wetland Areas/within 1 foot of permanent pool	1.00
Temporary Seeding	4.00

- B. Seed shall be applied in two equal applications for uniform coverage; direction of travel of spreader for second pass shall be perpendicular to that of the first pass. Seeding shall not be done when it is raining or snowing, or when wind velocity exceeds 5 mph.
  - 1. At the Contractor's option, and with the permission of the Engineer/Landscape Architect, seed may be spread by the hydroseeding method in areas where slice seeding is not practicable, utilizing power equipment commonly used for that purpose. Seed, lime, fertilizer, and mulch shall be mixed and applied to achieve application quantities specified herein for the conventional seeding method, with mulch applied at the rate of 1,200 lb./acre. Other provisions specified above for conventional seeding shall apply also to hydroseeding.

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- C. Following seeding the area shall be lightly raked to mingle seed with top 1/8 to 1/4 in. of soil. Area shall then be fine graded. Stones and other debris greater than 1 in. in any dimension which are visible on surface shall be removed. Surface shall be rolled with a hand roller having a weight of 60 to 90 lb./ft. of width, and a minimum diameter of 2 ft.
- D. Following seeding and raking, entire area shall be watered by use of lawn sprinklers, or other approved means. Initial watering shall continue until the equivalent of a 2 in. depth of water has been applied to entire seeded surface, at a rate which will not dislodge the seed. Watering shall be repeated thereafter as frequently as required to prevent drying of the surface, until the grass attains an average height of 1 inch. Watering methods and apparatus which may cause erosion of the surface shall not be permitted.

### 3.6 SODDING

- A. Edges of the sodded areas shall be smooth, and all sodded areas shall conform to the design cross sections and grade. At edges adjacent to curbs, paved areas, etc., top surface of earth in sod shall be 1/2 in. below adjacent hard surface.
- B. Sod shall be placed and all sodding operations completed within 72 hours following stripping from sod source bed.
- C. On slopes steeper than 2 to 1, sod shall be fastened in place with suitable wood pins or other approved methods, spaced at not less than 1 pin per square foot.
- D. Surface of completed sodded area shall be smooth. Sod shall be laid edge-to-edge, with tight-butted, staggered joints. Sod shall be carefully placed to insure that it is neither stretched or overlapped. Immediately after laying sod shall be pressed firmly into contact with sod bed by tamping or rolling, to eliminate air pockets. Following compaction, topsoil shall be used to fill all cracks, and excess soil shall be worked into grass with rakes or other suitable equipment. Sod shall not be smothered with excess fill soil.
- E. Immediately after sodding operations have been completed, entire surface shall be compacted with a cultipacker roller or other approved equipment weighing 100 to 160 lb./ft. of roller.
- F. Completed sod shall immediately be watered sufficiently to uniformly wet the soil to at least 1 in. below the bottom of sod bed.

### 3.7 MAINTENANCE

- A. Except as otherwise specified below, maintenance shall include all operations required to produce an established lawn, including but not limited to: Fertilizing, resodding, mowing, weeding, watering, or reseeded.
- B. Maintenance of seeded areas shall begin upon completion of seeding or and shall continue until full turf establishment and acceptance of the lawn or seeded area, until mowing as specified below is completed, or until average height of grass is 1-1/2 in., whichever occurs later.

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- C. Maintenance of sodded areas shall begin upon completion of sodding and shall continue for 45 days thereafter, unless sodding is not completed until after September 15, in which case maintenance shall continue until the June 15 following.
- D. After grass has sprouted, seeded areas, which fail to show a uniform stand of grass shall be replanted as often as necessary to establish an acceptable stand of grass.
  - 1. Scattered bare spots shall not exceed 50 sq. in. each.
  - 2. Multiple bare spots shall not exceed 5 sq. ft. within a 500 sq. ft. area.
- E. First mowing shall be done when average height of grass is 3 in., with mower set to cut at a height of 2 in. Subsequent mowings shall be made at not over one week intervals, with the height of cut set at 2 in. With prior permission of the Owner, mowings during periods of slow growth or dormancy may be spaced at greater intervals.
- F. If lawn or grass is established in the fall and maintenance is required to continue into spring months, lawn and grass shall receive an application of lime and fertilizer in the spring. Lime and fertilizer shall be spread in a uniform layer over the entire lawn surface, at the rates recommended by a soil test administered at that time.

**END OF SECTION**

SECTION 32 93 00

TREES, PLANTS AND GROUND COVERS

PART 1 - GENERAL

1.1 WORK INCLUDED

- A. Provide all materials and equipment, and do all work required to complete the planting, as indicated on the Drawings and as specified.

1.2 SECTION INCLUDES

- A. Divisions 01 through 33 Sections for requirements specific to the work of each of these Sections.

1.3 RELATED WORK

- A. Examine Contract Documents for requirements that affect work of this Section. Other Specification Sections that directly relate to work of this Section include, but are not limited to:
  - 1. Section 31 10 00 – Site Clearing. Clearing and grubbing, and stripping of topsoil.
  - 2. Section 31 20 00 – Earth Moving. Establishment of subgrade elevations and excavation and backfill.
  - 3. Section 32 92 00 – Turf and Grasses. Seeding and sodding.

1.4 REFERENCES

- A. Comply with applicable requirements of the following standards. Where these standards conflict with other specified requirements, the most restrictive requirements shall govern.
  - 1. American National Standards Institute, Inc. (ANSI):
    - Z60.1 American Standard for Nursery Stock  
(Sponsor: American Association of Nurserymen, Inc.)
  - 2. American Society for Testing and Materials (ASTM):
    - C 136 Sieve Analysis of Fine and Coarse Aggregates
    - E 11 Wire-Cloth Sieves for Testing Purposes
  - 3. American Wood Preservers' Association (AWPA):
    - C2 Lumber, Timbers, Bridge Ties and Mine Ties –  
Preservative Treatment By Pressure Processes

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- 4. "Hortus Third", A Concise Dictionary of Plants Cultivated in the United States and Canada, Cornell University, L.H. Bailey Hortorium, MacMillian Publishing Co., New York, NY.

**1.5 SUBMITTALS**

- A. Submit under provisions of Division 1.
- B. Samples: The following samples shall be submitted:

<u>Material</u>	<u>Sample Size or Quantity (lb)</u>
Mulch	1
Planting soil	1
Topsoil from on-site sources	1
Topsoil from off-site sources	1
Each plant species	Actual representative sample, or picture with scale; include information on sources

- C. Manufacturer's Product Data: Manufacturer's product data shall be submitted for the following materials:

- Aluminum sulfate
- Antidessicant
- Fertilizer
- Fungicide
- Insecticide
- Compost

- D. Certificates: Labels from the manufacturer's container certifying that the product meets the specified requirements shall be submitted for the following materials:

- Compost
- Commercial fertilizer
- Limestone

- E. Test Reports: Test reports from an approved testing agency indicating compliance with the specifications shall be submitted for topsoil, planting soil mixture, and any other materials designated by the Engineer/Landscape Architect.

**1.6 OWNER'S INSPECTION AND TESTING**

- A. Work will be subject to inspection at all times by the Engineer/Landscape Architect. The Owner reserves the right to engage an independent testing laboratory in accordance with requirements of Section 01 45 00, QUALITY CONTROL to analyze and test materials used in the construction of the work. Where directed by the Engineer/Landscape Architect, the testing laboratory will make material analyses and will report to the Engineer/Landscape Architect whether materials conform to the requirements of this specification.

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1. Cost of tests and material analyses made by the testing laboratory will be borne by the Owner when they indicate compliance with the specification, and by the Contractor when they indicate non-compliance.
2. Testing equipment will be provided by and tests performed by the testing laboratory. Upon request by the Engineer/Landscape Architect, shall provide such auxiliary personnel and services needed to accomplish the testing work.
3. Gradation of granular materials shall be determined in accordance with ASTM C 136. Sieves for determining material gradation shall be as described in ASTM E 11.

### 1.7 CONTRACTOR'S INSPECTION AND TESTING

- A. Testing, analyses, and inspection required by the Contractor for his own information or guidance shall be at his own expense.
- B. The Contractor shall engage an independent testing agency, experienced in the testing of agricultural soils and acceptable to the Engineer/Landscape Architect, to perform the following tests and analyses:

<u>Material</u>	<u>Tests and Analysis Required</u>
Topsoil	Mechanical analysis of soil indicating the percent passing by weight of the following sieve sizes: 1 in., 1/2 in., No. 4, No. 10, No. 100, and No. 200. Determination of pH, organic content, and nutrient content. Recommendations shall be made by the testing agency as to the type and quantity of soil additives required to bring nutrient content and pH to satisfactory levels for planting.
Compost	Determination of moisture absorption capacity, organic matter content, and pH.

1. Materials shall not be used in construction until test results have been reviewed by the Engineer/Landscape Architect.
2. All costs associated with testing shall be at Contractor's expense.

### 1.8 SOURCE QUALITY CONTROL

- A. Identification of plant names shall be as listed in "Hortus Third".
- B. Selection of Plant Materials: Submit to the Engineer/Landscape Architect the names and locations of nurseries proposed as sources of acceptable plant material. Inspect all nursery materials to determine that the materials meet the requirements of this section. Proposed materials shall be flagged at the nurseries by the Contractor prior to viewing by the Engineer/Landscape Architect.

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1. Schedule with the Engineer/Landscape Architect a time for viewing plant material at the nursery. Trips to nurseries shall be efficiently arranged to allow Engineer/Landscape Architect to maximize his viewing time. A minimum of six weeks shall be allowed for this viewing prior to time that plants are to be dug.
2. Engineer/Landscape Architect may choose to attach his seal to each plant, or representative samples.
3. Where requested by the Engineer/Landscape Architect, photographs of plant material or representative samples of plants shall be submitted.
4. Viewing and/or sealing of plant materials by the Engineer/Landscape Architect at the nursery does not preclude the Engineer/Landscape Architect's right to reject material at the site of planting.

### 1.9 UNAVAILABILITY OF PLANT MATERIALS

- A. No changes or substitutions may be made without prior approval by the Engineer/Landscape Architect, and municipal authority, if applicable. If unavailability of plant material becomes a concern, then submit satisfactory evidence of advertisement for a one month period in a field-related trade journal or online, without success, or submit written substantiation that specific material is unavailable from at least six reliable and approved sources. Provide alternative availability data or substitution recommendations for approval prior to purchase and installation.

### 1.10 DELIVERY, STORAGE, AND HANDLING

- A. Digging Plant Material: Plants shall not be dug at the nursery or approved source until the Contractor is ready to transport them from their original locations to the site of the work or acceptable storage location.
- B. Transportation of Plant Material: Plants transported to the project in open vehicles shall be covered with tarpaulins or other suitable covers securely fastened to the body of the vehicle to prevent injury to the plants. Closed vehicles shall be adequately ventilated to prevent overheating of the plants.
  1. Plants shall be kept moist, fresh, and protected at all times. Such protection shall encompass the entire period during which the plants are in transit, being handled, or are in temporary storage.
  2. The roots of bareroot stock shall be protected from drying out with wet straw or other suitable material while in transit.
  3. Unless otherwise authorized by the Engineer/Landscape Architect, notify the Engineer/Landscape Architect at least two working days in advance of the anticipated delivery date of any plant material. A legible copy of the bill of lading, showing the

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quantities, kinds, and sizes of materials included for each shipment shall be furnished to the Engineer/Landscape Architect.

- C. Storage: Unless specific authorization is obtained from the Engineer/Landscape Architect, plants shall not remain on the site of work longer than three days prior to being planted.
1. Plants that are not planted immediately shall be protected as follows:
    - a. Earth balls shall be kept moist and their solidity carefully preserved.
    - b. Plants shall not be allowed to dry out or freeze.
  2. Bareroot plants may remain on the site of the work only 24 hours before being planted or placed in storage. During this 24-hour period, injury and desiccation of plants on-site shall be prevented.
    - a. Roots of plants in storage shall first be puddled in a paste solution of prepared planting soil and then watered.
    - b. Plants shall then be protected and kept moist by "heeling-in" the roots or by placing the plant in a cool moist storage building. The "heeling-in" procedure shall require the plants to be separated and the roots heeled in a suitable moist soil. If plants are stored in a building, the roots shall be covered with suitable moist mulch.
  3. Both the duration and method of storage of plant materials shall be subject to the approval of the Engineer/Landscape Architect.
- D. Handling of Plant Materials: Exercise care in handling plant materials to avoid damage or stress.

### 1.11 REJECTION OF MATERIALS

- A. Evidence of inadequate protection following digging, carelessness while in transit, or improper handling or storage, shall be cause for rejection.
- B. Upon arrival at the temporary storage location or the site of the work, plants shall be inspected for proper shipping procedures. Should the roots be dried out, large branches be broken, balls of earth broken or loosened, or areas of bark be torn, the Engineer/Landscape Architect will reject the injured plant.
- C. When a plant has been rejected, remove it from the area of the work and replace it with one of the required size and quality.

### 1.12 PLANTING SEASON

- A. Spring Planting: Spring planting may commence as soon as the ground has thawed at the nursery and at the site of planting, and weather conditions make it practicable to work both at the nursery and at the site. The planting period shall be April 1 to October 15.



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- B. Regardless of the dates specified above, planting shall only be performed when weather and soil conditions are suitable for planting the material specified in accordance with locally accepted practice.
- C. Planting season may be extended only with the written permission of the Engineer/Landscape Architect.

### 1.13 ACCEPTANCE

- A. The Engineer/Landscape Architect will inspect all work for Substantial Completion upon written notice of completion. The request shall be received at least ten calendar days before the anticipated date of inspection.
- B. Acceptance of installed plant material will be given by the Engineer/Landscape Architect for general conformance to specified installation procedures, size, character, and quality, and shall not diminish responsibility for full conformance to the Contract Documents.
- C. Upon completion and reinspection of all repairs or renewals necessary in the judgment of the Engineer/Landscape Architect, the Engineer/Landscape Architect will recommend to the Owner that Acceptance of the work of this Section be given.
- D. Acceptance in Part:
  - 1. The work may be accepted in parts when it is deemed to be in the Owner's best interest to do so, and when permission is given to the Contractor in writing to complete the work in parts.
  - 2. Acceptance and use of such areas by the Owner shall not waive any other provisions of this Contract.

### 1.14 MAINTENANCE

- A. Plant material shall be maintained as described in Part 3 of this Section until the Acceptance of work.
- B. Following Acceptance, maintenance of plant material shall become the Owner's responsibility. Provide instructions and service as follows:
  - 1. Provide Owner with typewritten recommended maintenance program at time of Substantial Completion.
  - 2. Make as many periodic inspections as necessary during the guarantee period, at no additional cost to the Owner, to inspect the condition of all plant materials. Submit written report of each inspection to the Engineer/Landscape Architect outlining corrective measures required to keep the guarantee valid.

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### 1.15 GUARANTEE

- A. Plants shall be guaranteed for a period of one year after the date of Acceptance by the Owner and Engineer/Landscape Architect.
  - 1. When the work is accepted in parts, the guarantee periods shall extend from each of the partial acceptances to the terminal date of the last guarantee period. Thus, all guarantee periods terminate at one time.
- B. Plants shall be healthy, free of pests and disease, and in flourishing condition at the end of the guarantee period. Plants shall be free of dead and dying branches and branch tips, and shall bear foliage of normal density, size, and color.
- C. Replace dead plants and all plants not in a vigorous, thriving condition, as determined by the Engineer/Landscape Architect during and at the end of the guarantee period, without cost to the Owner, as soon as weather conditions permit and within the specified planting period.
  - 1. Replacements shall closely match adjacent specimens of the same species. Replacements shall be subject to all requirements stated in this Specification.
  - 2. Make all necessary repairs due to plant replacements. Such repairs shall be done at no extra cost to the Owner.
  - 3. The guarantee of all replacement plants shall extend for an additional one-year period from the date of their acceptance after replacement. In the event that a replacement plant is not acceptable during or at the end of the said extended guarantee period, the Owner may elect one more replacement or credit for each item.
- D. At the end of the guarantee period, and no less than five days prior to final inspection, staking and guying materials shall be removed from the site.

### 1.16 FINAL INSPECTION AND FINAL ACCEPTANCE

- A. At the end of the guarantee period, the Engineer/Landscape Architect will, upon written notice of end of guarantee period inspect the work for Final Acceptance. Request shall be received at least ten calendar days before the anticipated date for Final Inspection.
- B. Upon completion and reinspection of full repairs or replacements necessary in the judgment of the Engineer/Landscape Architect at that time, the Engineer/Landscape Architect will recommend to the Owner that Final Acceptance of the Work of this Section be given.

## PART 2 - PRODUCTS

### 2.1 PLANTS

- A. Except as otherwise specified, size and grade of plant materials shall conform to ANSI Z60.1. In no case shall ball size be less than 11 in. in diameter for each inch of caliper.

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- B. Plants shall have outstanding form; symmetrical, heavily branched with an even branch distribution, densely foliated and/or budded, and a strong, straight, distinct leader where this is characteristic of species. Plants shall possess a normal balance between height and spread. The Engineer/Landscape Architect will be the final arbiter of acceptability of plant form.
- C. Plants shall be healthy and vigorous, free of disease, insect pests and their eggs, and larvae.
- D. Plants shall have a well-developed fibrous root system.
- E. Plants shall be free of physical damage such as scrapes, broken or split branches, scars, bark abrasions, sunscalds, fresh limb cuts, disfiguring knots, or other defects. These defects shall not interrupt more than 25% of the circumference of the plant cambium.
- F. Plants shall meet the sizes indicated on the Plant List. Plants larger or smaller than specified may be used only if accepted by the Engineer/Landscape Architect.
- G. Where a size or caliper range is stated, at least 50% of the material shall be closer in size to the top of the range stated.
- H. Plants shall not be pruned before delivery.
- I. Plants indicated as "B&B" shall be balled and burlapped.
  - 1. Unless otherwise permitted by the Engineer/Landscape Architect, plants shall be nursery grown.
  - 2. Plants shall be grown for at least two years under climatic conditions similar to those in the locality of the Project.
  - 3. Nursery grown plants shall be freshly dug. No heeled in plants or plants from cold storage will be accepted, unless otherwise permitted by the Engineer/Landscape Architect.
- J. Container grown plants shall be well rooted and established in the container in which they are growing. They shall have grown in the container for a sufficient length of time for the root system to hold the planting medium when taken from the container, but not long enough to become root bound. Container grown plants exceeding the sizes indicated in ANSI Z60.1 shall have containers which are not less than 75% of the ball sizes for comparable B&B plant material. Each container plant shall be inspected and root pruned as needed.
  - 1. Canes or Trunk(s) and Branches:
    - a. Very well formed and sturdy.
    - b. Branching plentiful and uniformly distributed to form a well-balanced plant.
    - c. Scars shall be free of rot and not exceed 1/4 the diameter of the wood beneath in greatest dimension unless completely healed (except pruning scars).
    - d. Pruning scars clean cut leaving little or no protrusion from the trunk or branch.
    - e. Graft union completely healed.

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- f. No mechanical or pest damage.
  - g. No extreme succulence.
2. Foliage:
- a. Densely supplied with healthy, vigorous leaves of normal size, shape, color, and texture (except shrubs moved bare-root or deciduous shrubs when dormant).
  - b. No holes, cavities, or depressed areas caused by broken or dead branches or insufficient foliage.
  - c. No chlorosis.
  - d. Pest or mechanical damage barely perceptible with no more than 5% of total foliage affected.
  - e. No frost or cold damage discernible.
3. Root System:
- a. Sturdily established in container.
  - b. Shall not be excessively rootbound except plants deliberately grown rootbound to produce a dwarf plant.
  - c. No large roots growing out of container.
  - d. No noxious weeds in container.
- K. Bareroot stock, where specified or approved by Engineer/Landscape Architect, shall meet the standards of ANSI Z60.1 and shall conform to the following:
- 1. Root System. The root system of bareroot stock shall be sufficient to insure plant growth.
  - 2. Bareroot Trees. Bareroot trees shall have a heavy fibrous root system that has been developed by proper cultural treatment, transplanting, and root pruning. The spread of the root system shall be 12 times greater than the trunk diameter plus an additional 6 in.
  - 3. Bareroot Shrubs. Bareroot shrubs shall have a well-developed fibrous root system, with a minimum spread conforming to the following:

<u>Plant Height, ft.</u>	<u>Minimum Spread of Roots, in.</u>
1.5 to 2	10
2 to 3	11
3 to 4	14
4 to 5	16
5 to 6	18
6 to 8	20

**2.2 TOPSOIL**

- A. Topsoil shall be obtained from a previously established stockpile on the site, to the extent that suitable material is available. Additional topsoil required shall be obtained from off-site sources.

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- B. Topsoil, whether stripped from site or supplied from off-site, shall be a sandy loam as defined by the USDA Soil Conservation Service, Soil Classification System, and shall have the following mechanical analysis:

<u>Textural Class</u>	<u>% of Total Weight</u>	<u>Average %</u>
Sand (0.05-2.0 mm dia. range)	45 to 75	60
Silt (0.002-0.05 mm dia. range)	15 to 35	25
Clay (less than 0.002 mm dia. range)	5 to 25	15

1. 95% of topsoil shall pass a 2.0 mm sieve.
2. Topsoil shall be free of stones 1 in. in longest dimension, earth clods, plant parts, and debris.
3. Organic matter content shall be 4 to 12% of total dry weight.

### 2.3 COMPOST

- A. Compost shall be highly organic dark brown to black containing 6-10% organic matter tested on a dry weight basis with pH between 6.0 – 8.0, free of plants, their roots, debris; other extraneous matter >1 in. diameter and shall be uncontaminated by foreign matter, or substances harmful to plant growth. Do not use soil for planting while in a frozen or muddy condition.

### 2.4 PLANTING SOIL

- A. Planting soil for all plant material except trees shall be a mixture of 2 parts existing soil and 1 part compost or topsoil or 1 part sandy fill if heavy soils.
- B. Planting soil shall have pH value range of 5.5 to 7.0.
1. If planting soil mixture does not fall within the required pH range, limestone or aluminum sulfate shall be added to bring the pH within the specified limit.

### 2.5 LIMESTONE

- A. Ground limestone shall be an agricultural limestone containing a minimum of 85% total carbonates, by weight. Ground limestone shall be graded within the following limits:

<u>Sieve Size</u>	<u>% Passing by Weight</u>
No. 10	100
No. 20	90
No. 100	60

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2.6 WATER

- A. Water shall be suitable for irrigation and shall be free from ingredients harmful to plant life.

2.7 ALUMINUM SULFATE

- A. Aluminum sulfate shall be unadulterated and shall be delivered in containers with the name of the material and manufacturer and net weight of contents.

2.8 COMMERCIAL FERTILIZER

- A. Fertilizer content shall conform to the following:

<u>Constituent</u>	<u>% Present by Weight</u>
Nitrogen (N)	10
Phosphorus (P)	0
Potassium (K)	10

- 1. 50% of nitrogen shall be derived from natural organic source of ureaform.
- 2. Fertilizer shall be phosphorus-free.
- 3. Potassium shall be derived from muriate of potash containing 60% potash.

- B. Fertilizer shall be delivered in manufacturer's standard container printed with manufacturer's name, material weight, and guaranteed analysis.
- C. Fertilizers with N-P-K analysis other than that stated above may be used provided that the application rate per square foot of nitrogen, phosphorus, and potassium is equal to that specified.
- D. Controlled-release fertilizer shall be equal to the following:

<u>Product</u>	<u>Manufacturer</u>
Agriform 20-10-5	Sierra Chemical Co.
Planting Tablets	Milpitas, CA 95035
EZY-Grow Fertilizer Packet	EZY-Grow - Landscape Specialties

Phosphorus-free controlled-release fertilizer is preferred, if available.

- E. Slow release fertilizer for seasonal plantings shall be Osmocote slow release 14-14-14 analysis (or preferred phosphorus-free).

2.9 EROSION CONTROL MATERIAL – JUTE MESH

- A. Jute Mesh: Jute mat 4 feet in width, made of unbleached, undyed and loosely twisted yarn woven in a grid with approximately ½ inch openings.

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- B. Anchoring Staples: Cold-drawn 14-gauge or wider in diameter formed in a U-shape from a wire 12 inches or longer.

### 2.10 SOIL SEPARATION FABRIC

- A. Nonwoven Geotextile Filter Fabric: Polypropylene or polyester fabric 3 oz./sq. yd. minimum.

### 2.11 MULCH

- A. Mulch shall be a 100% fine-shredded pine bark, of uniform size and free from rot, leaves, twigs, debris, stones, or any material harmful to plant growth. Bark shall have been shredded and stockpiled no less than two months and no more than two years before use.

### 2.12 GUYING AND STAKING MATERIALS

- A. Wood Stakes: For trees under 10 ft. in height, straight, sound, rough sawn lumber not less than 2 x 2 in., if square, or 2-1/2 in. diameter, if round. Wire for staking shall be 12-gauge steel or polyethylene ties per the detail.
- B. Wire for Guying: Galvanized steel 1 x 19 preformed 3/16 in. diameter.
- C. Turnbuckles: Galvanized steel fitted with eyebolts.
- D. Deadman: Sound, rough sawn lumber 2 x 4 in., or other material approved by the Engineer/Landscape Architect.
- E. Hose: High quality braided rubber hose, 3/4 in. diameter and suitable length, black in color.

### 2.13 ANTIDESICCANT

- A. Antidesiccant shall be an emulsion specifically manufactured for plant protection which provides a protective film over plant surfaces which is permeable enough to permit transpiration. Antidesiccant shall be delivered in manufacturer's sealed containers and shall contain manufacturer's printed instructions for use.
- B. Antidesiccant shall be equal to the following:

<u>Product</u>	<u>Manufacturer</u>
Wilt-Pruf	Wilt-Pruf Products, Inc. P.O. Box 469 Essex, CT 06426

### 2.14 FUNGICIDE

- A. General: Chemicals registered and approved by EPA, acceptable to authorities having jurisdiction, and of type recommended by manufacturer for each specific problem and as

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required for Project conditions and application. Do not use restricted chemicals unless authorized in writing by authorities having jurisdiction.

1. Fungicide shall be zinc ethylene bisdithiocarbonate (Zineb), or equal.

### PART 3 - EXECUTION

#### 3.1 EXAMINATION OF SUBGRADE

- A. Examine subgrade and rough grading before planting. Alert Engineer/Landscape Architect to unacceptable rough grading or subgrade.

#### 3.2 DRAINAGE OF SOILS

- A. Test drainage of five plant beds and pits chosen by the Engineer/Landscape Architect shall be done by filling with water twice in succession. The time at which water is put into the pit or bed for a second filling shall be noted. Engineer/Landscape Architect shall then be notified of the time it takes for pit or bed to drain completely. Planting operations shall not proceed until Engineer/Landscape Architect has reviewed test drainage results.
- B. Notify the Engineer/Landscape Architect in writing of all soil or drainage conditions that he considers detrimental to growth of plant material. Submit proposal and cost estimate for correction of the conditions for Engineer/Landscape Architect's approval before starting work.

#### 3.3 LAYOUT OF PLANTING AREAS

- A. Individual plant locations and outlines of shrub and ground cover areas to be planted shall be staked by the Contractor in ample time to allow inspection by the Engineer/Landscape Architect.
- B. Digging shall not begin until locations are approved by the Engineer/Landscape Architect.
- C. Location of trees shall be staked using color-coded stakes. A different stake color shall be used for each tree species.

#### 3.4 PREPARATION OF SUBGRADE

- A. Subgrade of planting areas shall be loosened or scarified to a minimum depth of 3 in. prior to spreading planting soil. Subgrade shall be brought to true and uniform grade and shall be cleared of stones greater than 2 in., sticks, and other extraneous material.

#### 3.5 PLANT PIT EXCAVATION

- A. Planting pits for trees and shrubs shall be excavated to the depth and dimension indicated on the Drawings.
- B. Excavation shall not begin until locations are approved by the Engineer/Landscape Architect.



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### 3.6 EROSION CONTROL MATERIAL – JUTE MESH

- A. After grassing, jute mesh shall be installed in areas indicated on the Plans on slopes between 2H:1V and 3H:1V, or as directed by the Engineer/Landscape Architect. It may also be installed across areas to be planted on slopes between 3H:1V and 4H:1V.
  - 1. Roll out in the direction of flow.
    - a. Anchor the top edge of the mesh in a 6 inch deep trench.
    - b. For all overlaps, place the upstream or uphill section on top.
  - 2. Overlap adjacent strips and adjoining ends by at least 6 inches.
  - 3. Apply jute mesh without stretching. Lay it evenly but loosely on the soil surface.
  - 4. To keep the area smooth, do not walk directly on the seedbed before or after applying mesh.
  - 5. Crosses may be cut to install plants, with yarn flattened in place after backfilling.
- B. Hold matting strips firmly in place with one row of staples as follows:
  - 1. Staple along each edge, spacing staples no more than 3 ft. apart in each row.
  - 2. At the ends of the covered area and at overlapping joints, space staples no more than 18 inches apart.
  - 3. Ensure that staples remain flush with the ground.

### 3.7 SOIL SEPARATION FABRIC

- A. Filter fabric shall be installed where indicated on the Drawings. Unless otherwise indicated on the Drawings, filter fabric shall be overlapped 6 in. along all edges
- B. Soil separation fabric shall be installed in raised planters to separate soil backfill from lower drainage layer or larger aggregates.

### 3.8 SPREADING OF PLANTING SOIL

- A. Planting soil shall be spread and placed to required depths.
- B. Surfaces shall be graded and smoothed, eliminating all sharp breaks by rounding, scraping off bumps and ridges, and filling in holes and cuts.

### 3.9 PLANTING

- A. Walls of plant pits shall be dug so that they are vertical and scarified.
- B. Plants shall be set as indicated on Drawings. Plants shall have same relationship to finished grade as in the nursery.

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- C. Plants shall be turned to the desired orientation when required by Engineer/Landscape Architect.
- D. Containerized plants shall be removed from container taking care not to damage roots. The side of the root ball shall be scarified to prevent root-bound condition and plant positioned in planting pit.
- E. Planting shall be positioned in center of planting pit, set plumb, and rigidly braced in position until all planting soil has been tamped solidly around the ball.
- F. Pits for shrubs shall be backfilled with planting soil. Tree pits shall be backfilled with existing soil, no planting soil. Soil shall be worked carefully into voids and pockets, tamping lightly every 6 in.
  - 1. When pit is two-thirds full, plants shall be watered thoroughly, and water left to soak in before proceeding.
  - 2. At this time, ropes or strings on top of ball shall be cut and removed. Burlap or cloth wrapping shall be completely removed once plant is set in pit. Ball wrapping and support wire shall be totally removed from ball and planting pit.
  - 3. Remove nursery plant identification tags.
- G. Backfilling and tamping shall then be finished and a saucer formed around plant pits as indicated on the Drawings.
- H. Saucer shall be filled with water and water left to soak in. Saucer shall then be filled with water again.
- I. Following planting of aquatic plant material, 3 in. layer of gravel shall be spread to stabilize soil beneath.

### 3.10 BULBS AND HERBACEOUS PERENNIALS

- A. Prepare perennial planting beds by application of fertilizers and pH-altering amendments and thoroughly rototilling into the top 12 in. prior to planting bulbs and flowering plants.

### 3.11 APPLICATION OF FERTILIZER

- A. Fertilizer shall be applied when planting pits are backfilled two-thirds full. Fertilizer application shall be of the type, rate, and timing recommended by the testing agency for each plant type.
- B. Slow-release fertilizer:
  - 1. Fertilization schedule for trees and shrubs using slow release 4 oz. packet system shall be per manufacturer's recommendations.

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2. Fertilizer packets shall be placed 6 to 8 in. deep below top of planting soil around root balls of plants. Packets shall be spaced evenly depending on the number of packets required.

### 3.12 FUNGICIDE SPRAYING

- A. Immediately after planting, all trunks of deciduous trees shall be sprayed with fungicide, applied as directed by chemical manufacturer.

### 3.13 STAKING AND GUYING

- A. Each tree shall be staked or guyed immediately following planting. Plants shall stand plumb after staking or guying.
- B. Duckbill Tree Support Systems shall be installed in strict conformance with manufacturer's published installation instructions.
- C. Duckbill Root Ball Fixing Systems shall be installed in strict conformance with manufacturer's published installation instructions.

### 3.14 MULCHING

- A. Mulch shall be applied as follows (entire area listed shall be mulched):

<u>Plant Type</u>	<u>Mulch Area</u>	<u>Mulch Depth, in.</u>
Tree	Saucer	3
Shrub	Saucer or Bed	3
Groundcover	Bed	3

### 3.15 PRUNING

- A. Each tree and shrub shall be pruned to preserve the natural character of the plant. Pruning shall be done after delivery of plants and after plants have been inspected and approved by the Engineer/Landscape Architect. Pruning procedures shall be reviewed with Engineer/Landscape Architect before proceeding.
- B. Pruning shall be done with clean, sharp tools. Cuts shall be made flush, leaving no stubs. No tree paint shall be used.
- C. Dead wood, suckers, and broken and badly bruised branches shall be removed.

### 3.16 MAINTENANCE OF PLANTING

- A. Maintenance shall begin immediately after each plant is planted and shall continue until Final Acceptance. The Contractor shall provide water for irrigation if none is available on site.
- B. Maintenance shall consist of pruning, watering, cultivating, weeding, mulching, removal of dead material, repairing and replacing of tree stakes, tightening and repairing of guys, resetting

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plants to proper grades and upright position, and furnishing and applying such sprays as are necessary to keep plantings free of insects and disease, and in a healthy growing condition.

- C. Planting areas shall be kept free of weeds, grass, and other undesired vegetative growth.
- D. Note: Extend maintenance beyond Substantial or Final Acceptance of Project if necessary to meet above requirements. Engineer/Landscape Architect may withhold funds from Substantial and Final Completion payments as necessary to assure proper performance of maintenance operations.

**END OF SECTION**

SECTION 33 05 00

COMMON WORK RESULTS FOR UTILITIES

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes the following:
  - 1. Piping joining materials.
  - 2. Sleeves.
  - 3. Identification devices.
  - 4. Grout.
  - 5. Piping system common requirements.
  - 6. Equipment installation common requirements.
  - 7. Concrete bases.
  - 8. Supports and anchorages.
  - 9. Utility testing.

1.2 DEFINITIONS

- A. Exposed Installations: Exposed to view outdoors or subject to outdoor ambient temperatures and weather conditions.
- B. Concealed Installations: Concealed from view and protected from weather conditions and physical contact by building occupants but subject to outdoor ambient temperatures. Examples include installations within unheated shelters.

1.3 SUBMITTALS

- A. Product Data: For the following:
  - 1. Storm drain, underdrain, water, sewer, pipe and fittings.
  - 2. Appurtenances including manholes, catch basins, grease traps, cleanouts, pipe manifolds, pipe insulation, flared inlets, rain guards, and manhole bases.
  - 3. Submittals for appurtenances shall show the angle for any pipe entrances as well as the height or elevation of the penetration.

1.4 QUALITY ASSURANCE

- A. Testing of Sanitary Sewer System (Gravity Main):
  - 1. Sanitary Sewer Testing: Testing of a section of sewer between manholes shall be performed using the below stated equipment according to stated procedures and under the observation of the Owner's representative. The Contractor shall notify the City of Portland Public Works Department, Division of Stormwater and Sewer (PPW) at least 72 hours in

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advance of the date and time of the testing in order for PPW to have an opportunity to have a representative on site during the tests.

- a. Pneumatic plugs shall have a sealing length equal to or greater than the diameter of the pipe to be inspected.
  - b. Pneumatic plugs shall resist internal test pressures without requiring external bracing or blocking.
  - c. All air used shall pass through a single control panel.
  - d. Three (3) individual hoses shall be used for the following connections:
    - 1) From control panel to pneumatic plugs for inflation.
    - 2) From control panel to sealed line for introducing the low pressure air.
    - 3) From sealed line to control panel for continually monitoring the air pressure rise in the sealed line.
2. Procedures: All pneumatic plugs shall be seal tested before being used in the actual test installation. One (1) length of pipe shall be laid on the ground and sealed at both ends with the pneumatic plugs to be checked. Air shall be introduced into the plugs to 25 psig. The sealed pipe shall be pressurized to 5 psig. The plugs shall hold against the pressure without bracing and without movement of the plugs out of the pipe.
- a. After a manhole to manhole reach of pipe has been backfilled and cleaned, and the pneumatic plugs are checked by the above procedure, the plugs shall be placed in the line at each manhole and inflated to 25 psig. Low pressure reaches 4 psig greater than the average back pressure of any ground water that may be over the pipe. At least two minutes shall be allowed for the air pressure to stabilize.

After the stabilization period (3.5 psig minimum pressure in the pipe), the air hose from the control panel to the air supply shall be disconnected. The portion of line being tested shall be termed "acceptable" if the time required in minutes for the pressure to decrease from 3.5 to 2.5 psig (greater than the average back pressure of any ground water that may be over the pipe) shall not be less than the time shown for the given diameters in the following table:

<b>Diameter (inches)</b>	<b>Minimum Allowable Pipe Minutes to Decrease from 3.5 - 2.5 psig Pressure In</b>
4	2.0
6	3.0
8	4.0
10	5.0
12	6.0
15	7.5
18	9.0
21	10.5

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3. In areas where ground water is known to exist, the Contractor shall install a one-half (1/2) inch diameter capped pipe nipple, approximately ten (10) inches long, through the manhole wall on top of one of the sewer lines entering the manhole. This shall be done at the time the sewer line is installed. Immediately prior to the performance of the Line Acceptance Test, the ground water shall be determined by removing the pipe cap, blowing air through the pipe nipple into the ground so as to clear it, and then connecting a clear plastic tube to the nipple.

The hose shall be held vertically, and a measurement of the height in feet shall be divided by 2.3 to establish the pounds of pressure that will be added to all readings. (For example, if the height of water is 11-1/2 feet, then the added pressure will be 5 psig, and the 2.5 psig to 7.5 psig. The allowable drop of one pound and the timing remain the same.)

4. If installation fails to meet the above requirements for the air test, the Contractor shall locate and repair the pipeline until an acceptable test is achieved.
5. The Contractor shall provide as required the proper plugs, weirs, and other equipment required to perform all tests. Testing of each section of sewer installed shall include the portions of service connections that are to be installed under the Contract.
6. Where ground water is confirmed to be high, the Engineer at his option may elect to accept infiltration measurements in lieu of air testing.
7. These tests shall be conducted at all times in the presence of the Owner's representatives. Should a line which has previously been tested indicate any water infiltration, or otherwise appear suspect to the representatives, the Contractor shall conduct confirmation air tests on the line at no additional costs.

### 1.5 DEFLECTION TESTING

- A. Deflection tests shall be performed on all flexible pipe. The test shall be conducted after the final backfill has been in place at least 30 days.
- B. No pipe shall exceed a deflection of 5 percent.
- C. If the deflection test is to be run using a right ball or mandrel, it shall have a diameter equal to 95 percent of the inside diameter of the pipe. The test shall be performed without mechanical pulling devices.

### 1.6 MANHOLE AND APPURTENANCE TESTING

- A. All sanitary manholes, wet wells, septic tanks, holding tanks, and other appurtenant structures shall be tested as to water tightness. If the initial test fails, a retest shall be required. The Contractor has the option of either of the following methods:
  1. Water Test: The inlet and outlet of the structure shall be plugged by watertight plugs furnished by the Contractor, and the manhole shall be filled with water. The water shall remain for sufficient time for the absorption into the concrete pipe to have been substantially completed. The amount of water loss from the manhole shall then be determined. The rate

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shall not exceed five (5) gallons per hour. Obvious leaks shall be repaired by the Contractor by excavating outside the structure, if required, at no cost to the Owner.

2. Vacuum: The manholes shall be vacuum tested by a method and apparatus subject to the prior approval of the Engineer. Vacuum testing shall be performed in the following manner:

The manhole shall be fully assembled, including all pipe connections into the structure. The manhole shall be in its final location and shall not have been backfilled prior to the performance of the test.

All lift holes shall be plugged with a non-shrinking mortar, as approved by the Engineer.

The seal between the manhole sections shall be in accordance with ASTM C923.

The Contractor shall plug the pipe openings, taking care to securely brace the plugs and the pipe.

With the vacuum tester set in place:

- Inflate the compression band to effect a seal between the vacuum base and the structure.
- Connect the vacuum pump to the outlet port with the valve open.
- Draw a vacuum to 10" of Hg. and close the valve.
- The test shall pass if the vacuum remains at 10" Hg. or drops to 9" Hg. in a time greater than one minute. If the manhole fails the initial test, the Contractor shall locate the leak and make proper repairs. Leaks may be filled with a wet slurry of accepted quick setting material.

Any appurtenant structure which shows obvious infiltration, whether tested or not, shall be sealed to eliminate said infiltration.

### 1.7 WATER MAIN TESTING:

- A. Test water distribution system installed below grade and into the building to the base of the riser in accordance with following procedures:
  1. The Contractor shall notify Portland Water District (PWD) at least 72 hours in advance of any testing on new water mains, in order for PWD to have an opportunity to have a representative on site during the tests.
  2. Before pressure testing the water main, air shall be completely expelled from the pipe. If permanent air valves are not located at all high points, corporation stops shall be installed at all high points so that the air can be expelled as the pipe is being filled. After completion of the test, the corporation stops shall either be removed or left in place at the discretion of the Owner.



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3. 2. If fire hydrants are installed on the new water main, the test shall be conducted against a closed hydrant valve.
4. The test pressure shall be 1.5 times the static pressure at the lowest point of elevation of the line and shall not be less than 150 p.s.i.
5. The test shall not exceed the pipe or thrust restraint design pressures, nor exceed twice the rated pressure of the valves or hydrants and shall not exceed the rated pressure of the valves, if resilient – sealed butterfly valves are used.
6. Water, only, shall be used to bring the main to the required test pressure. The type of pump shall be approved by the Mechanical Engineer.
7. The test shall be of at least two hours in duration. A leakage test shall be conducted immediately after the pressure test.
8. After the pressure test period, water shall be pumped into the main to bring the pressure back up to the initial test pressure. No pipe installation shall be accepted if the leakage is greater than that listed in Table 1 attached to this Section.

If any pipe installation shows a leakage greater than that specified in Table 1, the contractor at his own expense shall locate and repair the leak until it is within the specified allowance.

9. The pressure and leakage tests shall be witnessed by the Owner's representative.
  10. New hydrants shall be flowed with the static and residual pressures measured in accordance with NFPA 291.
- B. Utility Grade/Alignment Check of the Design Alignment. Survey checks, mirrors, or lasers may be employed to verify conformance with these standards.

## PART 2 - PRODUCTS

### 2.1 PIPING JOINING MATERIALS

- A. Pipe-Flange Gasket Materials: Suitable for chemical and thermal conditions of piping system contents.
1. ASME B16.21, nonmetallic, flat, asbestos free, 1/8-inch (3.2-mm) maximum thickness, unless otherwise indicated.
    - a. Full-Face Type: For flat-face, Class 125, cast-iron and cast-bronze flanges.
    - b. Narrow-Face Type: For raised-face, Class 250, cast-iron and steel flanges.
  2. AWWA C110, rubber, flat face, 1/8 inch (3.2 mm) thick, unless otherwise indicated; and full-face or ring type, unless otherwise indicated.

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- B. Flange Bolts and Nuts: ASME B18.2.1, carbon steel, unless otherwise indicated.
- C. Plastic, Pipe-Flange Gasket, Bolts, and Nuts: Type and material recommended by piping system manufacturer, unless otherwise indicated.
- D. Solvent Cements for Joining Plastic Piping:
  - 1. ABS Piping: ASTM D 2235.
  - 2. CPVC Piping: ASTM F 493.
  - 3. PVC Piping: ASTM D 2564. Include primer according to ASTM F 656.
  - 4. PVC to ABS Piping Transition: ASTM D 3138.
- E. Fiberglass Pipe Adhesive: As furnished or recommended by pipe manufacturer.

### 2.2 SLEEVES

- A. Galvanized-Steel Sheet Sleeves: 0.0239-inch (0.6-mm) minimum thickness; round tube closed with welded longitudinal joint.
- B. Steel Pipe Sleeves: ASTM A 53/A 53M, Type E, Grade B, Schedule 40, galvanized, plain ends.
- C. Cast-Iron Sleeves: Cast or fabricated "wall pipe" equivalent to ductile-iron pressure pipe, with plain ends and integral waterstop, unless otherwise indicated.
- D. Molded PVC Sleeves: Permanent, with nailing flange for attaching to wooden forms.
- E. PVC Pipe Sleeves: ASTM D 1785, Schedule 40.
- F. Molded PE Sleeves: Reusable, PE, tapered-cup shaped, and smooth outer surface with nailing flange for attaching to wooden forms.

### 2.3 IDENTIFICATION DEVICES

- A. Equipment Nameplates: Metal permanently fastened to equipment with data engraved or stamped.
  - 1. Data: Manufacturer, product name, model number, serial number, capacity, operating and power characteristics, labels of tested compliances, and essential data.
  - 2. Location: Accessible and visible.
- B. Plastic Tape: Manufacturer's standard color-coded, pressure-sensitive, self-adhesive vinyl tape, at least 3 mils (0.08 mm) thick.
  - 1. Width: 1-1/2 inches (40 mm) on pipes with OD, including insulation, less than 6 inches (150 mm); 2-1/2 inches (65 mm) for larger pipes.
  - 2. Color: Comply with ASME A13.1, unless otherwise indicated.

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- C. Valve Tags: Stamped or engraved with 1/4-inch (6.4-mm) letters for piping system abbreviation and 1/2-inch (13-mm) sequenced numbers. Include 5/32-inch (4-mm) hole for fastener.
1. Material: Valve manufacturer's standard solid plastic.
  2. Size: 1-1/2 inches (40 mm) in diameter, unless otherwise indicated.
  3. Shape: As indicated for each piping system.
- D. Valve Tag Fasteners: Brass, wire-link or beaded chain; or brass S-hooks.
- E. Engraved Plastic-Laminate Signs: ASTM D 709, Type I, cellulose, paper-base, phenolic-resin-laminate engraving stock; Grade ES-2, black surface, black phenolic core, with white melamine subcore, unless otherwise indicated. Fabricate in sizes required for message. Provide holes for mechanical fastening.
1. Engraving: Engraver's standard letter style, of sizes and with terms to match equipment identification.
  2. Thickness: 1/8 inch (3 mm), unless otherwise indicated.
  3. Thickness: 1/16 inch (1.6 mm), for units up to 20 sq. in. (130 sq. cm) or 8 inches (200 mm) in length, and 1/8 inch (3 mm) for larger units.
  4. Fasteners: Self-tapping, stainless-steel screws or contact-type permanent adhesive.
- F. Plastic Equipment Markers: Manufacturer's standard laminated plastic, in the following color codes:
1. Green: Cooling equipment and components.
  2. Yellow: Heating equipment and components.
  3. Brown: Energy reclamation equipment and components.
  4. Blue: Equipment and components that do not meet criteria above.
  5. Hazardous Equipment: Use colors and designs recommended by ASME A13.1.
  6. Terminology: Match schedules as closely as possible. Include the following:
    - a. Name and plan number.
    - b. Equipment service.
    - c. Design capacity.
    - d. Other design parameters such as pressure drop, entering and leaving conditions, and speed.

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7. Size: 2-1/2 by 4 inches (65 by 100 mm) for control devices, dampers, and valves; 4-1/2 by 6 inches (115 by 150 mm) for equipment.

### 2.4 GROUT

- A. Description: ASTM C 1107, Grade B, nonshrink and nonmetallic, dry hydraulic-cement grout.
  1. Characteristics: Post hardening, volume adjusting, nonstaining, noncorrosive, nongaseous, and recommended for interior and exterior applications.
  2. Design Mix: 5000-psi (34.5-MPa), 28-day compressive strength.
  3. Packaging: Premixed and factory packaged.

## PART 3 - EXECUTION

### 3.1 PIPING INSTALLATION

- A. Install piping according to the following requirements and Division 33 Sections specifying piping systems.
- B. Drawing plans, schematics, and diagrams indicate general location and arrangement of piping systems. Indicated locations and arrangements were used to size pipe and calculate friction loss, expansion, pump sizing, and other design considerations. Install piping as indicated unless deviations to layout are approved on the Coordination Drawings.
- C. Install piping indicated to be exposed and piping in equipment rooms and service areas at right angles or parallel to building walls. Diagonal runs are prohibited unless specifically indicated otherwise.
- D. Install piping to permit valve servicing.
- E. Install piping at indicated slopes.
- F. Install piping free of sags and bends.
- G. Install fittings for changes in direction and branch connections.
- H. Select system components with pressure rating equal to or greater than system operating pressure.
- I. Sleeves are not required for core-drilled holes.
- J. Permanent sleeves are not required for holes formed by removable PE sleeves.
- K. Install sleeves for pipes passing through concrete and masonry walls and concrete floor and roof slabs.
  1. Cut sleeves to length for mounting flush with both surfaces.

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- a. Exception: Extend sleeves installed in floors of equipment areas or other wet areas 2 inches (50 mm) above finished floor level.
2. Install sleeves in new walls and slabs as new walls and slabs are constructed.
  - a. PVC Pipe Sleeves: For pipes smaller than NPS 6 (DN 150).
  - b. Steel Sheet Sleeves: For pipes NPS 6 (DN 150) and larger, penetrating gypsum-board partitions.
- L. Verify final equipment locations for roughing-in.
- M. Refer to equipment specifications in other Sections for roughing-in requirements.

### 3.2 PIPING JOINT CONSTRUCTION

- A. Join pipe and fittings according to the following requirements and Division 33 Sections specifying piping systems.
- B. Ream ends of pipes and tubes and remove burrs. Bevel plain ends of steel pipe.
- C. Remove scale, slag, dirt, and debris from inside and outside of pipe and fittings before assembly.
- D. Threaded Joints: Thread pipe with tapered pipe threads according to ASME B1.20.1. Cut threads full and clean using sharp dies. Ream threaded pipe ends to remove burrs and restore full ID. Join pipe fittings and valves as follows:
  1. Apply appropriate tape or thread compound to external pipe threads unless dry seal threading is specified.
  2. Damaged Threads: Do not use pipe or pipe fittings with threads that are corroded or damaged. Do not use pipe sections that have cracked or open welds.
- E. Welded Joints: Construct joints according to AWS D10.12/D10.12M, using qualified processes and welding operators according to Part 1 "Quality Assurance" Article.
- F. Flanged Joints: Select appropriate gasket material, size, type, and thickness for service application. Install gasket concentrically positioned. Use suitable lubricants on bolt threads.
- G. Pressure-Sealed Joints: Assemble joints for plain-end copper tube and mechanical pressure seal fitting with proprietary crimping tool to according to fitting manufacturer's written instructions.
- H. Plastic Piping Solvent-Cemented Joints: Clean and dry joining surfaces. Join pipe and fittings according to the following:
  1. Comply with ASTM F 402 for safe-handling practice of cleaners, primers, and solvent cements.
  2. ABS Piping: Join according to ASTM D 2235 and ASTM D 2661 appendixes.

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3. CPVC Piping: Join according to ASTM D 2846/D 2846M Appendix.
4. PVC Pressure Piping: Join schedule number ASTM D 1785, PVC pipe and PVC socket fittings according to ASTM D 2672. Join other-than-schedule-number PVC pipe and socket fittings according to ASTM D 2855.
5. PVC Nonpressure Piping: Join according to ASTM D 2855.
6. PVC to ABS Nonpressure Transition Fittings: Join according to ASTM D 3138 Appendix.
- I. Plastic Pressure Piping Gasketed Joints: Join according to ASTM D 3139.
- J. Plastic Nonpressure Piping Gasketed Joints: Join according to ASTM D 3212.
- K. Plastic Piping Heat-Fusion Joints: Clean and dry joining surfaces by wiping with clean cloth or paper towels. Join according to ASTM D 2657.
  1. Plain-End PE Pipe and Fittings: Use butt fusion.
  2. Plain-End PE Pipe and Socket Fittings: Use socket fusion.
- L. Bonded Joints: Prepare pipe ends and fittings, apply adhesive, and join according to pipe manufacturer's written instructions.

### 3.3 PIPING CONNECTIONS

- A. Make connections according to the following, unless otherwise indicated:
  1. Install unions, in piping NPS 2 (DN 50) and smaller, adjacent to each valve and at final connection to each piece of equipment.
  2. Install flanges, in piping NPS 2-1/2 (DN 65) and larger, adjacent to flanged valves and at final connection to each piece of equipment.
  3. Install dielectric fittings at connections of dissimilar metal pipes.

### 3.4 EQUIPMENT INSTALLATION

- A. Install equipment level and plumb, unless otherwise indicated.
- B. Install equipment to facilitate service, maintenance, and repair or replacement of components. Connect equipment for ease of disconnecting, with minimum interference with other installations. Extend grease fittings to an accessible location.
- C. Install equipment to allow right of way to piping systems installed at required slope.

### 3.5 IDENTIFICATION

- A. Piping Systems: Install pipe markers on each system. Include arrows showing normal direction of flow.

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1. Plastic markers, with application systems. Install on insulation segment if required for hot noninsulated piping.
  2. Locate pipe markers on exposed piping according to the following:
    - a. Near each valve and control device.
    - b. Near each branch, excluding short takeoffs for equipment and terminal units. Mark each pipe at branch if flow pattern is not obvious.
    - c. Near locations where pipes pass through walls or floors or enter inaccessible enclosures.
    - d. At manholes and similar access points that permit view of concealed piping.
    - e. Near major equipment items and other points of origination and termination.
- B. Equipment: Install engraved plastic-laminate sign or equipment marker on or near each major item of equipment.
1. Lettering Size: Minimum 1/4 inch (6.4 mm) high for name of unit if viewing distance is less than 24 inches (610 mm), 1/2 inch (13 mm) high for distances up to 72 inches (1800 mm), and proportionately larger lettering for greater distances. Provide secondary lettering two-thirds to three-fourths of size of principal lettering.
  2. Text of Signs: Provide name of identified unit. Include text to distinguish among multiple units, inform user of operational requirements, indicate safety and emergency precautions, and warn of hazards and improper operations.
- C. Adjusting: Relocate identifying devices that become visually blocked by work of this or other Divisions.

### 3.6 CONCRETE BASES

- A. Concrete Bases: Anchor equipment to concrete base according to equipment manufacturer's written instructions and according to seismic codes at Project.
1. Construct concrete bases of dimensions indicated, but not less than 4 inches (100 mm) larger in both directions than supported unit.
  2. Install dowel rods to connect concrete base to concrete floor. Unless otherwise indicated, install dowel rods on 18-inch (450-mm) centers around the full perimeter of base.
  3. Install epoxy-coated anchor bolts for supported equipment that extend through concrete base, and anchor into structural concrete floor.
  4. Place and secure anchorage devices. Use supported equipment manufacturer's setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
  5. Install anchor bolts to elevations required for proper attachment to supported equipment.
  6. Install anchor bolts according to anchor-bolt manufacturer's written instructions.

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7. Use 3000-psi (20.7-MPa), 28-day compressive-strength concrete and reinforcement as specified in "Cast-in-Place Concrete" Section of the specifications.

### **3.7 ERECTION OF METAL SUPPORTS AND ANCHORAGES**

- A. Cut, fit, and place miscellaneous metal supports accurately in location, alignment, and elevation to support and anchor piped utility materials and equipment.
- B. Field Welding: Comply with AWS D1.1/D1.1M.

### **3.8 GROUTING**

- A. Mix and install grout for equipment base bearing surfaces, pump and other equipment base plates, and anchors.
- B. Clean surfaces that will come into contact with grout.
- C. Provide forms as required for placement of grout.
- D. Avoid air entrapment during placement of grout.
- E. Place grout, completely filling equipment bases.
- F. Place grout on concrete bases and provide smooth bearing surface for equipment.
- G. Place grout around anchors.
- H. Cure placed grout.

**END OF SECTION**



Table 1

## Allowable Leakage for Mechanical-Joint or Push-On Joint Pipe in 18-ft. Nominal Lengths\*

Avg. Test Pressure (psi)	Pipe Size - inches															
	2	3	4	6	8	10	12	14	16	18	20	24	30	36	42	48
Allowable Leakage per 1,000 ft-gph																
250	0.48	0.71	0.95	1.42	1.90	2.38	2.85	3.33	3.80	4.28	4.75	5.70	7.13	8.55	9.98	11.40
225	0.45	0.68	0.90	1.35	1.80	2.25	2.70	3.15	3.60	4.05	4.50	5.40	6.76	8.11	9.46	10.81
200	0.42	0.64	0.85	1.27	1.70	2.12	2.55	2.97	3.40	3.82	4.25	5.10	6.37	7.61	8.92	10.19
175	0.40	0.60	0.79	1.19	1.59	1.99	2.38	2.78	3.18	3.58	3.97	4.77	5.96	7.15	8.34	9.54
150	0.37	0.55	0.74	1.10	1.47	1.84	2.20	2.58	2.94	3.31	3.68	4.41	5.52	6.62	7.72	8.83
140	0.36	0.53	0.71	1.07	1.42	1.78	2.13	2.49	2.84	3.20	3.55	4.26	5.33	6.40	7.46	8.53
130	0.35	0.51	0.69	1.03	1.37	1.71	2.06	2.40	2.74	3.08	3.42	4.11	5.14	6.16	7.19	8.22
120	0.33	0.49	0.66	0.99	1.32	1.64	1.98	2.30	2.63	2.96	3.29	3.95	4.93	5.92	6.91	7.89
110	0.31	0.47	0.63	0.94	1.26	1.58	1.89	2.21	2.52	2.83	3.15	3.78	4.72	5.67	6.61	7.56
100	0.30	0.45	0.60	0.90	1.20	1.50	1.80	2.10	2.40	2.70	3.00	3.60	4.50	5.40	6.31	7.21
90	0.28	0.43	0.57	0.86	1.14	1.42	1.71	1.99	2.28	2.56	2.85	3.42	4.27	5.13	5.98	6.84
80	0.27	0.40	0.54	0.80	1.08	1.34	1.61	1.88	2.15	2.42	2.69	3.22	4.03	4.84	5.64	6.45
70	0.25	0.38	0.50	0.75	1.00	1.26	1.51	1.76	2.01	2.26	2.51	3.01	3.77	4.52	5.28	6.03
60	0.23	0.35	0.46	0.70	0.93	1.16	1.39	1.63	1.86	2.09	2.32	2.79	3.49	4.19	4.89	5.58
50	0.21	0.32	0.42	0.64	0.85	1.06	1.28	1.49	1.70	1.91	2.12	2.55	3.19	3.82	4.46	5.10
40	0.19	0.28	0.38	0.57	0.76	0.95	1.14	1.33	1.52	1.71	1.90	2.28	2.85	3.42	3.99	4.56

\*The allowable leakage for a pipeline is calculated by multiplying the leakage per hour per 1,000 feet at the average test pressure and for the diameter of pipe tested as obtained from the above table by the duration of the test in hours and the total length of the line being tested divided by 1,000. If the line under test contains sections of various diameters, the allowable leakage will be the sum of the computed leakage for each size.

SECTION 33 11 00

WATER UTILITY DISTRIBUTION PIPING

PART 1 - GENERAL

1.1 SUMMARY

- A. Furnish labor, materials, services, equipment, and other necessary items required for accompanying the construction of the water systems. This shall include, but not be limited to the following: pipe and fittings for onsite and offsite water line including domestic water line and fire water line, valves, set lines, elevations, and grades for water distribution systems. **Also, supply all tapping sleeves, tees and valves for connection to the existing water main.** Provide rigid insulation where cover is designated to be less than 4'-0".
- B. Related Sections:
  - 1. Section 32 11 00 – Base Courses.
  - 2. Section 31 20 00 – Earth Moving.
  - 3. Local Governing Authority and Code Requirements.
  - 4. All Necessary Construction Permits.
- C. The public water supply is owned and operated by the Portland Water District. All materials, installation, and workmanship shall comply with the requirements of the local water department, the Public Utilities Commission, the Maine State Plumbing Code and these specifications. Where a more stringent standard exists, the more stringent standard shall apply.

1.2 SUBMITTALS

- A. Product Data: Provide data on pipe materials, pipe fittings, hydrants, valves and accessories including ASTM designations, AWWA certifications and UL labels as required.
- B. Manufacturer's Certificate: Certify that products meet or exceed state or local requirements.

1.3 QUALITY ASSURANCE

- A. AASHTO T180 - Moisture-Density Relations of Soils Using a 10-lb (4.54 kg) Rammer and an 18-in. (457 mm) Drop.
- B. ANSI/ASTM D1557 - Test Methods for Moisture-Density Relations of Soils and Soil-Aggregate Mixtures Using 10-lb (4.54 Kg) Rammer and 18-in. (457 mm) Drop.
- C. ANSI/AWWA C104 - Cement-Mortar Lining for Ductile-Iron Pipe Fittings for Water.
- D. ANSI/AWWA C105 - Polyethylene Encasement for Ductile Iron Piping for Water and Other Liquid.

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- E. ANSI/AWWA C111 - Rubber-Gasket Joints for Ductile Iron and Grey-Iron Pressure Pipe and Fittings.
- F. ANSI/AWWA C151 - Ductile-Iron Pipe, Centrifugally Cast in Metal Molds or Sand-Lined Molds, for Water or Other Liquids.
- G. ANSI/AWWA C502 - Dry Barrel Fire Hydrants.
- H. ANSI/AWWA C508 - Swing-Check Valves for Waterworks Service, 2 in through 24 in NPS.
- I. ANSI/AWWA C509 - Resilient Seated Gate Valves 3 in through 12 in NPS, for Water and Sewage Systems.
- J. ANSI/AWWA C600 - Installation of Ductile-Iron Water Mains and Appurtenances.
- K. ANSI/AWWA C606 - Grooved and Shouldered Type Joints.
- L. ANSI/AWWA C900 - Standard for Polyvinyl Chloride (PVC) Pressure Pipe, 4 inch through 12 inch, for Water.
- M. ASTM D2922 - Test Methods for Density of Soil and Soil-Aggregate in Place by Nuclear Methods (Shallow Depth).
- N. ASTM D3017 - Test Methods for Moisture Content of Soil and Soil-Aggregate Mixtures.
- O. ASTM D3035 - Polyethylene (PE) Plastic Pipe (SDR-PR) Based on Controlled Outside Diameter.
- P. AWWA C901 - Polyethylene (PE) Pressure Pipe, Tubing, and Fittings, ½ inch through 3 inch, for water.
- Q. UL 246 - Hydrants for Fire - Protection Service.

### 1.4 PROJECT RECORD DOCUMENTS

- A. Accurately record actual locations of piping mains, valves, connections, and invert elevations. Record a minimum of two (2) lateral measurement “swing ties”, as close to 90 degrees opposed as practical, prior to backfilling pipeline from permanent fixtures such as building corners, telephone poles, fire hydrants, catch basins, manholes etc. to all valves, fittings, couplings, tees etc. for purposes of future location. Permanent fixtures shall be identified such as house numbers or description, pole numbers etc. These ties must be legibly recorded in sketch form and submitted to the Owner prior to final project acceptance. Record the same information with coordinates on the Maine State coordinate grid system for the record drawings.
- B. Identify and describe unexpected variations to subsoil conditions or discovery of uncharted utilities.

### 1.5 QUALITY ASSURANCE

- A. Perform work in accordance with utility company and/or municipality requirements.
- B. Valves: Manufacturer's name and pressure rating marked on valve body.

**PART 2 - PRODUCTS**

2.1 PIPE

- A. Pipe: Sizes less than 3" that are installed below grade and outside building shall comply with the following:
  - 1. Seamless Copper Tubing: Type "K" roll form to comply with ASTM B88-62. Fittings shall be brass compression manufactured by Ford, Mueller, or McDonald.
  
- B. Pipe: Sizes 4" and larger shall comply with the following:
  - 1. Ductile Iron Water Pipe: In accordance with ANSI A21.51. (AWWA C151) ductile iron pipe shall be cement mortar lined in accordance with AWWA C104. Joints shall meet requirements of AWWA C111. Push-on joint pipe to be supplied with gaskets and gasket lubricants. Pipe shall be 62-42-10 strength; 60,000 psi minimum tensile strength; 42,000 psi minimum yield strength; 12 but not including 16 inch shall have a Class 52 wall thickness. Size 16" and over shall have Class 51 wall thickness. The bituminous coating used for the sealing of the cement mortar lining shall be of a quality that will not have a deleterious effect on the quality, color, taste or odor of potable water.
  
- C. Ductile Iron Fittings: Fittings shall be North American manufactured by and material shall be ASTM A536-72 mini grade 70-50-05, in accordance with AWWA C110. Fittings shall be cement lined (AWWA C104-74). Interior seal coated (AWWA C104-74) and exterior bituminous coated. Mechanical joint with accessories furnished; D.I. glands, gaskets, Cor-Ten T-bolts and nuts; Class 350 pressure rating in accordance with AWWA C110. Thickness shall be equal to ductile iron pipe Class 53 in accordance with AWWA C151. All plain end fittings shall be beveled-edged (60o) to fit slip-joint fitting and shall be long body design.
  
- D. Retainer Glands: Glands shall be heavy duty ductile iron body as manufactured by Romac or Ebba Iron and shall have a minimum working pressure rating as follows:
  - 1. 4" – 350 psi (pounds per square inch)
  - 6" – 350 psi
  - 8" – 350 psi
  - 12" – 350 psi

Set screws shall be:

- 1. cupped syle ends;
- 2. composed of Cor-Ten Steel or Ductile Iron

The number of set screws shall be equal to or greater than the number of inches of nomial diameter of the gland (i.e. 4" – 4 set screws; 6" – 6 set screws, etc).

Gland shall meet AWWA specifications.

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### E. Bolts and Nuts: General description of properties required.

1. Stainless Steel: Type 316 - contains the addition of molybdenum to the nickel-chromium steels.

#### Specific Chemical Composition:

- a) Carbon - 0.08% max.
- b) Manganese - 2.00% max.
- c) Silicone - 1.00% max.
- d) Phosphorus - 0.04% max.
- e) Sulphur - 0.03% max.
- f) Chromium - 16-18.00%
- g) Nickel - 10-14.00%
- h) Molybdenum - 2-3.00%
- i) SAE No. - 30316
- j) ASM No. - 5361A, 5524A, 5573, 5648B, 5690D

2. Cor-Ten Steel: Trade name for cold formed T-head bolts containing alloying elements such as copper, nickel, and chrome.

#### Specific Chemical Composition:

- a) Carbon - 0.2% max.
- b) Manganese - 1.25% max.
- c) Sulphur - 0.05% max.
- d) Nickel - 0.25% min.
- e) Copper - 0.20% min.
- f) Combined - 1.25% min.  
(Ni,Cu,Cr)

- F. Resilient Sealed Gate Valve: Valve shall meet all provisions of ANSI/AWWA C509-87 specification as latest revised; shall have a smooth unobstructed water way which shall be a minimum of the nominal diameter of the valve. Valve ends to be specified and shall be furnished with Cor-Ten (or equal) bolts and nuts. Valves shall be manufactured by Mueller, American Flow Control or U.S. Pipe and shall open right.

- G. Valve Boxes: The valve box bottom section shall be slide-type with bell-type base. The valve box top section shall be slide-type. It shall have a top flange, but shall not have a "bead" or bottom flange. The valve box cover shall be a 2" drop-type cover to fit the 7-1/4" opening of the top section. The valve box extension shall be slide-type with a minimum 3" belled bottom. Material shall be cast iron or ductile free from defects. Interior and exterior of all components shall be bituminous coated with a minimum of 4 mils dry film thickness.

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### H. Service Box and Rod:

#### 1. Service Box Specification:

Shall be North American and 1.0" (in.) I.D. steel size (SCHEDULE 40) black iron with top having N.P.I. threads for 1.0" screw-on cover.

Shall be Erie style with 4-6' / 5-6' (ft.) slide-type riser.

#### 2. Service Box Cover Specifications:

Shall be North American, Quincy type (heavy-duty) cover that screws on (1.1 above).

Shall be tapped with a 1" rope thread with a solid brass plug with pentagon operating head.

#### 3. Service Box Foot Piece Specifications

The standard foot piece shall be North American, heavy-duty (Ford style or equal) cast iron design.

The large, heavy-duty foot piece shall have an arch that will fit over 2" ball-valve curb-stops.

#### 4. Service Rod Specifications

Shall be 24"-30" in length and have a self-aligning design.

Shall be of circular dimension and constructed of:

- a) 1/2" diameter minimum #304 stainless steel.

Shall have a yoke design that is an integral part of the rod.

The curb-stop attachment point shall be a brass cotter pin.

The rod "wrench-flat" shall have a minimum thickness of 1/4" tapered to 1/16" and width of 5/8" or 1/2".

### I. Tapping sleeves shall be as approved by Portland Water District. Options include the following:

The tapping sleeve shall be; 304 Stainless Steel Tapping Sleeves with ductile iron flange. Flange bolts shall be stainless steel or silicon bronze. The sleeve shall be rated for a maximum, working pressure of 200 psi. The interior and exterior shall be bituminous coated with a minimum of 4 millimeters dry film thickness. The sleeve shall be provided with a 3/4" F.I.P.T. test port and plug.

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### J. Corporation Stop:

1. 1" shall be a ball valve design with a brass ball that is Teflon (or equal) coated. 1-1/2" - 2" shall be ball corporation design with an on-off identification mark on the operating nut.
2. The valve shall be supported by 2 seats for water, tight shut-off in either direction.
3. The valve shall have a full port opening.
4. The body of the corporation-stop shall be of heavy-duty design.

### K. Specifications for Services:

#### 1. Material:

Copper Tubing: ASTM B88, Type K, Seamless, Annealed, 2 Inch Diameter Maximum.

#### 2. Fittings:

Brass compression manufactured by Ford, Mueller or McDonald.

### L. Curb Stops:

1. For sizes 1"-2", the valve shall be a brass ball that is Teflon (or equal) coated.
2. The ball shall be supported by seats, which are water tight in either direction.
3. The valve shall have a full-port opening.
4. The valve shall open with ¼ turn (90°) with a check or stop.
5. The valve shall NOT have a drain.
6. The valve stem shall have 2 "o" rings and a bronze ring lock, which holds the stem solidly in the valve body.
7. The valve body shall be a heavy-duty design.

### M. Hydrant: Hydrants shall be either American Flow Control's B-62-B, Mueller Centurion or U.S. Pipe's Metropolitan 250 all with stainless steel nuts and bolts below grade. The hydrant shall have an epoxy-coated base, and open right. The nozzles shall have National Standard Threads. Operating nut shall be 1-15/16".

All material used in the production of fire hydrants for ordinary service shall conform to the specifications designated for each material listed in AWWA Standard C502.

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- N. Joint Restraint: Place thrust blocking consisting of 2,500 psi concrete to provide sufficient bearing area to transmit unbalanced thrust from bends, tees, caps, or plugs to undisturbed soil without loading undisturbed soil in excess of 2,500 lbs./sq. ft. when water main pressure is 100 psi.

### MINIMUM THRUST BLOCKING BEARING AREAS

Pipe Diameter	Tees Sq. Ft.	90 Deg.Bend Sq. Ft.	45 Deg.Bend Sq. Ft.	22 Deg.Bend Sq. Ft.
4"	1.0	1.0	1.0	1.0
6"	1.5	2.0	1.0	1.0
8"	2.5	3.5	1.8	1.0
10"	4.0	5.5	2.8	1.5
12"	6.0	8.0	4.0	2.0
14"	8.0	11.0	5.5	3.0
16"	10.0	14.2	7.0	4.0

- O. Rigid Insulation: Installation, when required by the Drawings, shall be 2" Styrofoam SM or TG as manufactured by the Dow Chemical Company or equal.

Materials submitted shall have a K factor of .20 @ 75 degrees by ASTM C518-70, 2-lb. density by ASTM C303-56, compressive strength of 30-lb. by ASTM D1621-64 and a water absorption of less than .05 meet Federal Specifications HH1524B Type II, Class B.

- P. Temporary Water Service: Provide temporary water service as necessary during the site work and building construction. Utilize materials as approved by Portland Water District.

## PART 3 - EXECUTION

### 3.1 WATER DISTRIBUTION SYSTEM

- A. Building Service Lines: Install water service lines to point of connection within approximately five feet outside of buildings to which such service is to be connected and make connections thereto. If building services have not been installed provide temporary caps. Connections of service lines to distribution mains shall be constructed in accordance with the following requirements.
- 2 Inch and Larger: Connect by rigid connections and provide gate valve below frost line.
- B. Regrading: Raise or lower existing valve and curb stop boxes and fire hydrants to finish grade in areas being graded.
- C. Pipe Laying, General
- Install to same tolerances as specified for storm drain (Section 33 41 00).
  - Do not lay pipe on unstable material, in wet trench, or, when trench or weather conditions are unsuitable.



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3. Support pipe laid in fill area at each joint, by brick or concrete piers carried down to solid undisturbed earth.
4. Do not lay pipe in same trench with other pipes or utilities.
5. Hold pipe securely in place while joint is being made.
6. At least one foot shall separate water lines vertically from other pipes or underground structures.
7. Where water pipes cross sanitary sewers or are laid parallel and adjacent to them, bottom of water pipe shall be separated by not less than one foot above top of sewer and ten feet horizontally.
8. Do not work over, walk on, pipes in trenches until covered by layers of earth well tamped in place to a depth of 12 inches over pipe.
9. Full length of each section of pipe shall rest solidly upon pipe bed with recesses excavated to accommodate bells or joints. Do not lay pipes on wood blocking.
10. Install water lines to avoid storm and sanitary sewer lines.
11. Clean interior of pipe thoroughly of all foreign matter before installation. Keep pipes clean during laying operations by means of plugs or other methods. When work is not in progress, securely close open ends of pipe and fittings to prevent water, earth, or other substances from entering.
12. Tees, plugs, caps, bends and hydrants on pipe installed underground shall be anchored. Pipe clamps and tie rods, or concrete thrust blocks may be used. Type of pipe and soil conditions determine methods. Anchor water mains as specified in NFPA No. 24.
13. Close pipe openings with caps or plugs during installation. Tightly cover and protect equipment against dirt, water and chemical, or mechanical injury. At completion of all work thoroughly clean exposed materials and equipment.

### D. Laying Ductile Iron Pipe

1. Installing Pipe: Lay pipe in accordance with AWWA C600.
2. Joints:
  - a. Mechanical: AWWA C111. Provide sufficient quantities of bolts, nuts, glands and gaskets for each socket opening on pipe and fittings.
  - b. Push-On: Apply thin film of lubricant to gasket and place in proper position in contour of bell. Insert beveled end of joining pipe and make contact with

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gasket. Force beveled end of pipe to bottom of bell without displacing gasket. Do not caulk. Only lubricant furnished by manufacturer of pipe shall be used.

- c. Flanges: AWWA C115. Install only in concrete pits. Must be watertight and set not less than six inches from walls to floor.

### E. Setting of Valves:

1. Install gate valves as indicated on the Drawings and support on concrete pads with valve stem vertical and plumb. Install valve boxes in a manner that will not transmit loads, stress, or shock to valve body.
2. Center valve box over operating nut of valve vertical and plumb. Securely fit valve box together leaving cover flush with finished surface.
3. Clean valves and curb stops interior before installation.

### F. Setting of Fire Hydrants

1. Install fire hydrant assemblies as indicated on Drawings in vertical and plumb position with steamer nozzle pointed toward building unless otherwise directed by local authorities. Support hydrant assembly on concrete pad and firmly braced on side opposite inlet pipe against undisturbed soil or concrete blocking. Place minimum of 6 cu. ft. of crushed stone or gravel around hydrant base and barrel after thrust blocking has cured at least 24 hours. Exercise care when backfilling and compacting so proper vertical position will not be altered.
2. Clean interior of hydrants of all foreign matter before installation.
3. Set center of each hydrant not less than two (2) feet nor more than six (6) feet back of edge of road or face of curb. Set barrel flange not more than two (2) inches above finished grade and eighteen (18) inches between center of steamer nozzle and finished grade.

- G. Pipe Sleeves: Install where water lines pass through retaining and foundation walls. Properly secure in place, with approximately 1/4-inch space between pipe and enclosing sleeve, before concrete is poured. Caulk annular opening between pipe and sleeves, and seal with asphaltic compound consisting of bituminous materials mixed with mineral matter. Install piping so that no joint occurs within a sleeve. Split sleeves may be installed where existing lines pass through new construction.

- H. Meter: The Contractor will obtain the meter from the Portland Water District and install the domestic water meter for the installation and will pay all usage charges connected with water supply until the installation is accepted by the Owner.

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### 3.2 DISINFECTION

- A. Disinfect distribution system with chlorine before acceptance for domestic operation in accordance with the following procedures:
1. The only acceptable method of disinfection shall be the continuous Feed Method of chlorine.
  2. The rates of introduction of the chlorine and water shall be so proportioned so that the chlorine concentration in the water is maintained at a minimum of 50 mg/l available chlorine.
  3. During the application of the chlorine, valves shall be operated in such a manner that the treatment dosage shall not flow back into the line supplying the water. The operation of the valves shall be done under Water Department supervision.
  4. The chlorinated water shall be retained in the main for at least 24 hours. At the end of the 24 hour period, the treated water shall contain no less than 25 mg/l available chlorine.
  5. At the end of the retention period, the chlorinated water shall be flushed from the main until the chlorine in the water leaving the main is no higher than the normal residual in the system, or less than 1 mg/l.
  6. All bacteriological tests shall be collected in sample bottles and shall be tested at a State certified laboratory. All costs for disinfection of the main as well as bacteriological costs shall be borne by the Contractor.

### 3.3 TESTING OF WATER DISTRIBUTION SYSTEM

- A. Test water distribution system pipe sizes installed below grade and outside building in accordance with following procedures:
1. Before pressure testing the water main, air shall be completely expelled from the pipe. If permanent air valves are not located at all high points, corporation stops shall be installed at all high points so that the air can be expelled as the pipe is being filled. After completion of the test, the corporation stops shall either be removed or left in place at the discretion of the Water District.
  2. If fire hydrants are installed on the new water main, the test shall be conducted against a closed hydrant valve.
  3. The test pressure shall be 1.5 times the static pressure at the lowest point of elevation of the line and shall not be less than 150 p.s.i.

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4. The test shall not exceed the pipe or thrust restraint design pressures, nor exceed twice the rated pressure of the valves or hydrants and shall not exceed the rated pressure of the valves, if resilient - sealed butterfly valves are used.
5. Water, only, shall be used to bring the main to the required test pressure. The type of pump shall be approved by the Portland Water District.
6. The test shall be of at least two hours in duration. A leakage test shall be conducted immediately after the pressure test.
7. After the pressure test period, water shall be pumped into the main to bring the pressure back up to the initial test pressure. No pipe installation shall be accepted if the leakage is greater than that listed in Table 1 attached to this Section.

If any pipe installation shows a leakage greater than that specified in Table 1, the contractor at his own expense shall locate and repair the leak until it is within the specified allowance.

The pressure and leakage tests shall be conducted under Portland Water District's supervision.

**END OF SECTION**

SECTION 33 39 00

APPURTENANCES FOR UTILITIES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Monolithic concrete manholes with masonry transition to lid frame, covers, anchorage and accessories.
2. Modular precast concrete manhole sections with tongue-and-groove joints with masonry transition to lid frame, covers, anchorage and accessories.
3. Masonry manholes sections with masonry transition to lid frame, covers, anchorage and accessories.
4. Precast septic tank, holding tank, grease traps, and SEWER SYSTEM accessories when required on the contract drawings.

B. Related Sections:

1. Section 33 05 00 – Common Work Results for Utilities
2. Section 33 31 00 – Sanitary Utility Sewerage Piping
3. Local Governing Authority and Code Requirements
4. Construction Drawings

1.2 REFERENCES

- A. ANSI/ASTM C55 - Concrete Building Brick.
- B. ASTM A48 - Gray Iron Castings
- C. ASTM C478 - Precast Reinforced Concrete Manhole Sections.
- D. ASTM C923 - Resilient Connectors Between Reinforced Concrete Manhole Structures and Pipes.
- E. ASTM C1227-13 – Standard Specification for Precast Concrete Septic Tanks
- F. ASTM D1248 - Precast Polyethylene Manholes.
- G. International Masonry Industry All-Weather Council (IMIAC): Recommended Practices and Guide Specifications for Cold Weather Masonry Construction.

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### 1.3 SUBMITTALS

- A. Shop Drawings: For all precast structures indicate manhole locations, rim elevation, piping, sizes and elevations of proposed penetrations. For all other precast appurtenances, provide dimensional data, ASTM compliance certificates, and load capacity where applicable.
- B. Product Data: Provide manhole covers, component construction, features, configuration and dimensions. Each precast structure shall have a diagram showing the dimensions and location of all openings or penetrations.

## PART 2 - PRODUCTS

### 2.1 PRECAST CONCRETE ITEMS

- A. Precast Manhole and Sections: Manhole and super-structures shall be precast reinforced concrete of the dimensions indicated on the Plans conforming to ASTM Specification C478. Sections shall be installed with a flexible plastic gasket equal to or better than "Ram-Nek" as manufactured by K. T. Snyder Co., Houston, Texas, or sections may be fabricated to accept Tylox "O" rubber gaskets as manufactured by Hamilton Kent Manufacturing Co., Kent, Ohio. The casting and the outside of the brick work required to bring the rim to grade shall be plastered with at least 3/8" mortar, thoroughly troweled to leave a smooth waterproof vertical exterior surface.

Manhole steps shall be forged aluminum safety type, alloy 6061, temper T6, or reinforced polypropylene plastic. Steps shall be cast or anchored into walls of precast sections to form a ladder with a distance of 12 inches between steps.

The Contractor shall furnish the name of the manufacturer to the Engineer prior to commencing work.

- B. Precast Manhole Bases: Manhole bases shall be precast reinforced concrete of the dimensions indicated on the Plans conforming to ASTM Specification C478. Bases shall be placed on a well compacted layer of crushed stone.

Jointing system for pipe entering or leaving manholes shall be a flexible manhole sleeve cast in the base. A stainless steel pipe clamp shall be used to fix the pipe into the sleeve. All materials shall meet or exceed rubber quality standards of ASTM C-443 and C-361.

For manhole bases, a minimum of 4 inches shall be allowed between pipe invert and inside bottom of base for construction of brick inverts.

Where precast bases are used for drop manholes, a 6 inch concrete slab is to be placed under the base section large enough to receive the concrete encased drop pipes. Provide suitable ties between manhole sections and drop pipe encasements.

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Prior to ordering precast manhole bases, all angles between incoming pipes are to be field checked to incorporate possible line changes required in the field layout.

- C. Precast Tanks, Vaults and Appurtenances: Precast tanks, vaults, and appurtenances shall be constructed of precast reinforced concrete with inside dimensions conforming to those indicated on the contract drawings and conforming to ASTM C478. The tank may be a monolithic section or constructed with tongue and grooves with approved watertight sealants such as "o" rings. All penetrations through the tank shall use either cast in place wall sleeves with Link Seals or a flexible boot secured in the casting such as Kor N Seal. Any clamps or metallic connections shall be stainless steel.

The tanks, vaults, and appurtenances shall include shop drawings and submittals with supporting computations which demonstrate the tank can support an H<sub>2</sub>O loading, an equivalent external fluid pressure of 105 lb./cubic ft. (with the tank empty), and an internal fluid pressure of 65 lb./cubic ft. The pressures shall be assumed to apply from the base of the structure to the finish grade surface.

Tanks which require attachment to an anti-flotation slab shall use stainless steel angles and anchors sized to resist the uplift force.

The tanks shall be coated with a waterproof seal on the interior and exterior. Sections shall be fabricated to receive a watertight seal.

### 2.2 CASTINGS

- A. The Contractor shall furnish all cast iron frames, grates, and covers conforming to the details shown on the Drawings, or as hereinbefore specified.
- B. Castings shall be at least Class 25 conforming to the ASTM Standard Specifications for Gray Iron Castings, Designation A-48-64 except for the 12" NDS risers and 12" inlets.
- C. Sanitary sewer covers shall have the name "Sewer" cast therein.
- D. The manhole castings shall be a non-perforated manhole frame and cover, 24" clear opening as manufactured by the East Jordan Works Foundry or approved equal.

### 2.3 MORTAR

- A. Mortar used to adjust rims and covers for manholes shall consist of the following materials and proportions by volume: 1 part of Portland cement; 1/4 part lime hydrate; and 3 parts sand.
- B. For precast reinforced concrete manholes, mortar for invert construction shall consist of the following materials and proportions by volume: 1 part Portland cement and 2 parts sand. Quantity of water in mixture shall be sufficient to produce a stiff, workable mortar, but in no case shall exceed 5-1/2 gallons of water per sack of cement.

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### 2.4 BRICK

- A. Brick for manholes and catch basins shall meet Standard Specifications for Sewer Brick, AASHTO Designation M-91-42, Grade SA, Size No. 1 wire cut. Any brick rejected by the Engineer as unsuitable shall be immediately removed from the work.

### 2.5 SITE CONCRETE

- A. Site concrete shall meet the requirements set forth below:
  1. Aggregate: The aggregate shall conform to the Standard Specifications for Concrete Aggregates, ASTM Designation C-33, as revised.
    - (a) Sand shall be a medium sand with a fineness modules of 2.60 - 2.90.
    - (b) Coarse aggregate shall not exceed 1-1/2 inches for mass concrete.
  2. Cement: All cement shall be a Portland Cement conforming to the requirements of Standard Specifications of the American Society for Testing Materials, Designation C-150, as revised, Type II. An air entraining agent, approved by the Engineer, shall be used.
  3. Proportioning Concrete:

<u>Maximum Size Coarse Aggregate (Inches)</u>	<u>Air Content Percent by Volume</u>
1-1/2, 2, or 2-1/2	5 +/- 1
3/4 or 1	6 +/- 1

The strength of the concrete shall be fixed in terms of water-cement ratio in accordance with trial batches of the materials to be used. All concrete placed under this Specification shall be mixed in the ratio not to exceed six (6) U.S. gallons of water per sack of cement, including surface water carried by the aggregate in each case. The Contractor shall determine the approximate amount of surface water contained in the aggregate, and make proper allowance. Concrete shall have a minimum 28 day strength of 4000 psi. The Contractor shall submit the proposed mix proportions to the Engineer for approval ten (10) days prior to placing concrete. Copies of recent test results for the proposed mix design shall also be submitted.

### 2.6 REINFORCEMENT

- A. The Contractor shall submit detailed shop drawings for concrete reinforcement in accordance with ACI 318 and ACI 315. The steel shall be deformed Grade 60 bars which conform to ASTM 615, ASTM 616, or ASTM 617. Supports, spaces, and chairs shall permit the steel to be supported in accordance with ACI 318.



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### 2.7 TREATMENT OF INTERIOR SURFACES

- A. All interior surface of cast in place concrete structures shall have a liquid hardener applied. The application shall consist of two coats of VANDEX or approved equal installed in accordance with manufacturer's instructions including requirements for surface preparation. Catalog cuts of the hardener shall be submitted to the Engineer for approval. All interiors of concrete items shall be treated with a waterproof coating (18 mil. Film thickness).

### 2.8 TREATMENT OF EXPOSED SURFACES

- A. All exposed exterior concrete surfaces shall have a "rub finish". Structures and appurtenances shall have an applied coating of Tnemec Series 104 H5 Epoxy applied in 2 coats or approved equal to achieve a minimum dry film thickness of 18 mils. All light pole bases shall have an epoxy finish colored to match the pole color. One coat shall be applied in the factory, a second coat shall be applied in the field.

### 2.9 TREATMENT OF ALL OTHER EXTERIOR SURFACES

- A. All buried surfaces shall be double coated with a concrete hardener to achieve a minimum dry film thickness of 18 mils.

### 2.10 RAIN GUARD MANHOLE INSET

- A. A self sealing removable insert shall be provided and installed in the frame of each manhole casting. The purpose of this device is to collect and store illicit water that may enter the manhole casting. The units shall be "RAINGUARD™" or approved equal.

## PART 3 - EXECUTION

### 3.1 MANHOLES

- A. General: All appurtenant structures shall be set level on compacted material as shown on the Plans.
- B. Manhole Channels: Channels shall be constructed in all sanitary sewer manholes in accordance with the details shown on the Plans by a mason whose qualifications meet the approval of the Engineer or a channel of reinforced concrete cast with the manhole base. The sides shall be raised by brick masonry construction from the spring line perpendicular to the height of the crown of the pipe. Where changes in directions are made at manholes, the invert shall be shaped with as great a radius as possible, and to the complete satisfaction of the Engineer. Brick shall be carefully laid to present a smooth surface as indicated on the Plans and to the satisfaction of the Engineer.

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### C. Pipe Connections:

1. Stubs in Manholes: Stubs placed as specified and indicated on the Drawings shall be short pieces cut from the bell ends of appropriate pipe and shall have compatible watertight stoppers. Stubs shall be set accurately to the required line and elevation and encased in the structure masonry as indicated on the Drawings:
2. Wall Sleeves and Castings: Wall sleeves and castings as specified and indicated on the Drawings shall be accurately cast to the required location and elevations as indicated on the Drawings.

D. Steps: Manhole and appurtenant steps shall be cast in the wall and installed in a straight vertical alignment.

E. Infiltration Seal: Install rain guard or approved equal manhole inserts.

### 3.2 ALTERATIONS TO EXISTING MANHOLES

- A. Existing manholes to be altered shall be reconstructed as indicated on the Plans or as directed by the Engineer. Adjusting to grade or connecting to an existing pipe stub is not considered an alteration.
- B. Alterations covered include, but are not limited to, adjustments to manhole invert channel caused by new pipe connections or removal of existing pipe connections, and removal and plugging of existing catch basin lead and replacing with a new lead connection conforming to the appropriate section of the Specifications contained herein.

### 3.3 ADJUSTING EXISTING MANHOLES

- A. Existing manholes to be adjusted to grade shall be reconstructed to the required grade. The existing frames, grates, and covers shall be re-used unless otherwise directed.
- B. The existing structure shall be dismantled to a sufficient depth to allow reconstruction conforming to the standard details.
- C. Adjustment will take place just prior to placing of surface pavement for adjustments of the frame and cover. Adjustments which require dismantling and reconstruction of the super structure shall be accomplished at the time of subgrade preparation. Pavement which is removed for this adjustment shall be cut square, tack coated, and capped with 2" of bituminous concrete. No separate payment will be made for furnishing the bituminous cap.
- D. Each structure that is adjusted shall be cleaned of accumulated silt, debris, or foreign matter prior to final acceptance of the work.

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### 3.4 ABANDONING MANHOLES

- A. Existing manholes designated to be abandoned shall be removed to a depth of one (1) foot below the subgrade line, unless otherwise indicated on the Plans or directed by the Engineer. The existing pipes shall be plugged with concrete and brick masonry and the catch basins and manholes shall be filled with heavy gravel satisfactorily compacted in 9 inch lifts. Prior to backfilling, the sump shall be pumped and cleaned of all water and foreign material.

### 3.5 MANHOLE ADAPTERS

- A. When altering an existing manhole or where a pre manufactured manhole adapter cannot be installed in precast manhole sections, the Contractor shall use a Fernco, or equal, concrete manhole adapter. The adapter shall be designed to provide a positive, watertight seal between the manhole and pipe and shall be mortared in place with Five Star grout or approved equal non-shrink grout.

### 3.6 PRECAST TANKS, VAULTS, AND APPURTENANCES

- A. These precast items shall be set in a dry excavation, proof-rolled, and prepared with one of the following bedding materials:
  - Compacted  $\frac{3}{4}$ " crushed stone (8" min.),
  - Compacted MDOT 703.06 Type D gravel.

If the subgrade is weak and/or unstable, a layer of Mirafi 600X shall be installed between the prepared subgrade and the bedding.

- B. The anti-flotation slab shall be carefully laid out and aligned, and set on the bedding with reinforcement and forms set on a dry excavation site. Concrete shall be poured and protected from inclement weather during the cure period.
- C. Tanks shall be set on the anti-flotation slab. Where necessary for plumbness and level, the tank shall be shimmed with a strong slurry grout installed to fill the void space.
- D. Multiple section tanks shall be set in place using approved sealants. Double rows shall be required when joint mastics are used. An approved adhesive primer shall be installed prior to installing the mastics and setting the concrete.
- E. The tank shall be anchored to the anti-flotation slab with approved stainless steel masonry anchors. All anchors shall be inspected by the Contractor to assure the anchor is secure and will provide the required resistance.
- F. After anchorage, the tank excavation shall remain dewatered and backfilled. The backfill shall be brought up uniformly around the tank and compacted in place. Pipe connections shall occur after the tank has been backfilled to the level of the bottom of the pipe bedding.

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G. Any voids created by removal of sheeting, bracing or shielding shall be filled and recompact.

**3.7 TESTING**

A. Testing shall meet the requirements of Section 33 05 00 “Common Work Results for Utilities”.

**END OF SECTION**

SECTION 33 41 00

STORM UTILITY DRAINAGE PIPING

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes gravity-flow, non-pressure storm drainage outside the building, with the following components:
  - 1. Cleanouts.
  - 2. Precast concrete manholes.
  - 3. Flared inlets/outlets.
  - 4. Catch basins.

1.2 PERFORMANCE REQUIREMENTS

- A. Perimeter building underdrains are required and shall be installed as part of the site work. Refer to Section 33 46 00.
- B. Gravity-Flow, Nonpressure, Drainage-Piping Pressure Rating: Watertight when installed below permanent pond elevation, silt tight in other areas.

1.3 SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Shop Drawings: For manholes and catch basins. Include plans, elevations, sections, details, and manhole frames and covers and catch basin frames and grates.
- C. Coordination Drawings: Show pipe sizes, locations, and elevations for all manholes and appurtenances.
- D. Field quality-control test reports. Product Data: For each type of product indicated.

1.4 DEFINITIONS

- A. Bedding: Fill placed under, beside and directly beside pipe to midpoint of pipe, prior to subsequent backfill operations.
- B. Special Backfill: Fill placed above bedding beside and over pipe prior to other backfill operations.

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### 1.5 PROJECT RECORD DOCUMENTS

- A. Accurately record actual locations of pipes and mains, connections, catch basins, cleanouts and invert elevations.
- B. Identify and describe unexpected variations to subsoil conditions or discovery of uncharted utilities.

### 1.6 COORDINATION

- A. Coordinate the work with termination of storm connections outside building and trenching.
- B. The exact location of roof drain leaders shall be determined from the Architectural Plans and including as shown on the plumbing drawings. The number and location of the roof drains may be different than shown in the site drawings. Verify roof drain lead locations with the Owner. Provide fittings to raise grade to accept roof drain 5'-0" outside of building where necessary.
- C. All building underdrains shall be connected to the storm drainage system. Refer to Section 33 46 00.

## PART 2 - PRODUCTS

### 2.1 MANUFACTURERS

Provide any one of the following materials subject to any restrictions noted in this subsection or on plans. The Contractor shall provide catalog cuts to the Owner and indicate the proposed materials to be used prior to ordering materials. The approval of the Owner must be obtained prior to ordering materials.

- A. Reinforced Concrete Pipe: Comply with requirements of ASTM C 76, Class IV unless another class type is indicated on Drawings, installed with flexible plastic (Bitumen) gaskets at all joints. Gaskets shall comply with AASHTO M-198 75I, Type B, and shall be installed in strict accordance with pipe manufacturer's recommendations.
- B. Polyvinyl Chloride (PVC) Pipe: Pipe and fittings shall comply with ASTM D 3034, rated SDR 35. Pipe shall be continually marked with manufacturer's name, pipe size, cell classification, SDR rating, and ASTM D 3034 classification. Pipe joints shall be integrally molded bell ends in accordance with ASTM D 3034, Table 2, with factory supplied elastomeric gaskets and lubricant. PVC shall not be used for any drainage pipe which will be permanently exposed to sunlight.
- C. Corrugated Polyethylene Pipe (CPP), Smooth Interior: Shall conform with AASHTO Designations M294 and M252. Pipe must be installed in accordance with manufacturer's installation guidelines for culvert and other heavy duty drainage applications. Acceptable manufacturers: Advanced Drainage Systems, Inc. (ADS) N-12 and HANCOR, INC. (HiQ smooth interior). CPP pipe shall not be used for any drainage pipe which will be permanently exposed

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to sunlight. Piping below the water table, subject to surcharge, or which could affect a pond level, shall be watertight. All other piping shall be silt tight.

- D. Polyvinyl Chloride (PVC) Large Diameter Closed Profile Gravity Sewer Pipe, UNL-B-9: Pipe and fittings shall be installed in accordance with pipe manufacturer's installation guidelines. Acceptable manufacturer: CARLON (Vylon HC). PVC pipe shall not be used for any drainage pipe which will be permanently exposed to sunlight.
- E. Storm drain inlets, outlets, and culverts to include:
- Rip rapped aprons.
  - Concrete flared inlets/outlets for pipes larger than 18" in diameter.
  - Bar racks for pipes larger than 18" diameter.
  - HDPE flares for pipe smaller than 18" in diameter. High density polyethylene flares with added carbon black for exposure to sunlight.
- F. Manholes and Catch Basins Outlet Control Structures, Stilling, Basins, Water Quality Unit, and Water Quality Control Structures shall be provided where shown on the contract drawings.

### 2.2 CLEANOUTS

- A. Gray-Iron Cleanouts: ASME A112.36.2M, round, gray-iron housing with clamping device and round, secured, scoriated, gray-iron cover. Include gray-iron ferrule with inside calk or spigot connection and countersunk, tapered-thread, brass closure plug.
1. Manufacturers:
    - a. Josam Company.
    - b. MIFAB Manufacturing Inc.
    - c. Smith, Jay R. Mfg. Co.
    - d. Wade Div.; Tyler Pipe.
    - e. Watts Industries, Inc.
    - f. Watts Industries, Inc.; Enpoco, Inc. Div.
    - g. Zurn Industries, Inc.; Zurn Specification Drainage Operation.
  2. Top-Loading Classification(s): Heavy duty.
  3. Sewer Pipe Fitting and Riser to Cleanout: ASTM A 74, Service class, cast-iron soil pipe and fittings.

### 2.3 MANHOLES

- A. Standard Precast Concrete Manholes: ASTM C 478 (ASTM C 478M), precast, reinforced concrete, of depth indicated, with provision for sealant joints.
1. Diameter: 48 inches (1200 mm) minimum, unless otherwise indicated.
  2. Ballast: Increase thickness of precast concrete sections or add concrete to base section, as required to prevent flotation.

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3. Base Section: 6-inch (150-mm) minimum thickness for floor slab and 4-inch (100-mm) minimum thickness for walls and base riser section, and having separate base slab or base section with integral floor.
4. Riser Sections: 4-inch (100-mm) minimum thickness, and of length to provide depth indicated.
5. Top Section: Eccentric-cone type unless concentric-cone or flat-slab-top type is indicated. Top of cone of size that matches grade rings.
6. Joint Sealant: ASTM C 990 (ASTM C 990M), bitumen or butyl rubber.
7. Resilient Pipe Connectors: ASTM C 923 (ASTM C 923M), cast or fitted into manhole walls, for each pipe connection.
8. Steps: Individual FRP steps or FRP ladder, wide enough to allow worker to place both feet on 1 step and designed to prevent lateral slippage off of step. Cast or anchor steps into sidewalls at 12- to 16-inch (300- to 400-mm) intervals. Omit steps if total depth from floor of manhole to finished grade is less than 36 inches (900 mm).
9. Adjusting Rings: Interlocking rings with level or sloped edge in thickness and diameter matching manhole frame and cover. Include sealant recommended by ring manufacturer.
10. Grade Rings: Reinforced-concrete rings, 6- to 9-inch (150- to 225-mm) total thickness, to match diameter of manhole frame and cover.
11. Manhole Frames and Covers: Ferrous; 24-inch (610-mm) ID by 8-inch (203-mm) riser with 4-inch- (100-mm-) minimum width flange and 26-inch- (660-mm-) diameter cover. Include indented top design with lettering cast into cover, using wording equivalent to "STORM SEWER."
  - a. Material: ASTM A 48, Class 35 gray iron, unless otherwise indicated.

### 2.4 CONCRETE

- A. General: Cast-in-place concrete according to ACI 318/318R, ACI 350R, and the following:
  1. Cement: ASTM C 150, Type II.
  2. Fine Aggregate: ASTM C 33, sand.
  3. Coarse Aggregate: ASTM C 33, crushed gravel.
  4. Water: Potable.
- B. Ballast and Pipe Supports: Portland cement design mix, 3000 psi (20.7 MPa) minimum, with 0.58 maximum water-cementitious materials ratio.
  1. Reinforcement Fabric: ASTM A 185, steel, welded wire fabric, plain.
  2. Reinforcement Bars: ASTM A 615/A 615M, Grade 60 (420 MPa), deformed steel.



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### 2.5 CATCH BASINS

- A. Standard Precast Concrete Catch Basins: ASTM C 478 (ASTM C 478M), precast, reinforced concrete, of depth indicated, with provision for sealant joints.
1. Base Section: 6-inch (150-mm) minimum thickness for floor slab and 4-inch (102-mm) minimum thickness for walls and base riser section, and having separate base slab or base section with integral floor.
  2. Top Section: Eccentric-cone type unless flat-slab-top type is indicated.
  3. Joint Sealant: ASTM C 990 (ASTM C 990M), bitumen or butyl rubber.
- B. Frames and Grates: ASTM A 536, Grade 60-40-18, ductile iron designed for A-16, structural loading. Include 24-inch (610-mm) by 8-inch (203-mm) riser with 4-inch (102-mm) minimum width flange, and 26-inch- (660-mm-) diameter flat grate with bicycle proof drainage openings.
1. Grate Free Area: Approximately 50 percent, unless otherwise indicated.
  2. The location of catch basins shall be accurately located by a registered land surveyor. Catch basins shall be located as follows:
    - Edge of frame 6" off face of curb where shown near slopes granite or bit concrete curblines.
    - The center of aisle or parking modules when shown on plans.
    - In other cases, verify with Engineer.

## PART 3 - EXECUTION

### 3.1 PIPING APPLICATIONS

- A. Pipe couplings and fittings with pressure ratings at least equal to piping rating may be used in applications below, unless otherwise indicated.
1. Use non pressure-type flexible couplings where required to join gravity-flow, non-pressure sewer piping, unless otherwise indicated.
    - a. Flexible couplings for same or minor difference OD pipes.
    - b. Ring-type flexible couplings for piping of different sizes where annular space between smaller piping's OD and larger piping's ID permits installation.

### 3.2 PIPING INSTALLATION

- A. General Locations and Arrangements: Drawing plans and details indicate general location and arrangement of underground storm drainage piping. Location and arrangement of piping layout take design considerations into account. Install piping as indicated, to extent practical. Where specific installation is not indicated, follow piping manufacturer's written instructions.
- B. Install piping beginning at low point, true to grades and alignment indicated with unbroken continuity of invert. Place bell ends of piping facing upstream. Install gaskets, seals, sleeves,

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and couplings according to manufacturer's written instructions for using lubricants, cements, and other installation requirements.

- C. Install manholes for changes in direction unless fittings are indicated. Use fittings for branch connections unless direct tap into existing sewer is indicated.
- D. Install proper size increasers, reducers, and couplings where different sizes or materials of pipes and fittings are connected. Reducing size of piping in direction of flow is prohibited.
- E. Install gravity-flow, non-pressure drainage piping according to the following:
  - 1. Install piping pitched down in direction of flow, at the slope provided on the contract drawing.
  - 2. The pipe shall be accurately laid to the line and grades to the satisfaction of the Engineer. The line and grade may be adjusted by the Engineer from that shown on the Drawings to meet field conditions and no extra compensation shall be claimed therefore. The Owner or his representative reserves the right to check the elevations and alignment on any pipe for conformance with proposed line and grade. Installed grades shall be within the tolerance of plus or minus 0.02 feet from theoretical computed grades. Alignment shall be within a tolerance of plus or minus 0.04 feet. Pipe grade shall be defined as the invert elevation of the pipe. Pipe not meeting the grade tolerance or of poor alignment shall be adjusted by the Contractor.
  - 3. No pipe laying will be allowed to begin at any point other than a manhole or other appurtenance without the expressed consent of the Engineer. The interior of each length of pipe will be swabbed and wiped clean before laying the next length. No length of pipe shall be laid until the previous length has had sufficient fine material placed and tamped about it to secure it firmly in place to prevent any disturbance. Bell ends shall be laid uphill. Whenever the work is stopped temporarily, or for any reason whatsoever, the end of the pipe shall be carefully protected against dirt, water, or other extraneous material. Bedding shall be as shown on the Plans.
  - 4. The pipe shall be cut as necessary for appurtenances. In general, the pipe material shall be cut by using a saw or milling process, approved by the pipe manufacturer and not by using any impact device, such as a hammer and chisel, to break the pipe. The pipe shall be cut, not broken. The cut end of the pipe shall be square to the axis of the pipe and any rough edges ground smooth.
  - 5. Clean interior of all pipe thoroughly before installation. When work is not in progress, open ends of pipe shall be closed securely, in a manner approved by the Engineer, to prevent entrance of trench water, dirt, or other substances.
  - 6. All joints shall be made in a dry trench in accordance with the manufacturer's recommendations.
  - 7. A minimum of two (2) pipe lengths or pipe stubs shall be used between any two (2) appurtenances.

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8. When connections are made between new work and existing piping, make connection using suitable fittings for conditions encountered. Make each connection with existing pipe at time and under conditions which least interfere with operation of existing pipeline service. Provide facilities for dewatering and for disposal of water removed from dewatering lines and excavations without damage to adjacent properties.
  9. Install piping below frost line or with rigid insulation where required by profiles and details.
  10. Install hub-and-spigot, cast-iron soil piping according to CISPI's "Cast Iron Soil Pipe and Fittings Handbook."
  11. Install PVC sewer piping according to ASTM D 2321 and ASTM F 1668.
- F. Clear interior of piping and manholes of dirt and superfluous material as work progresses.

### 3.3 PIPE JOINT CONSTRUCTION

- A. Basic pipe joint construction is specified in Division 33 Section "Common Work Results for Utilities." Where specific joint construction is not indicated, follow piping manufacturer's written instructions.
- B. Join gravity-flow, non-pressure drainage piping according to the following:
1. Join hub-and-spigot, cast-iron soil piping with gasket joints according to CISPI's "Cast Iron Soil Pipe and Fittings Handbook" for compression joints.
  2. Join PVC sewer piping according to ASTM D 2321 and ASTM D 3034 for elastomeric-gasket joints.
  3. Join dissimilar pipe materials with non-pressure-type flexible couplings.

### 3.4 CLEANOUT INSTALLATION

- A. Install cleanouts and riser extensions from sewer pipes to cleanouts at grade. Use cast-iron soil pipe fittings in sewer pipes at branches for cleanouts and cast-iron soil pipe for riser extensions to cleanouts. Install piping so cleanouts open in direction of flow in sewer pipe.
1. Use light-duty, top-loading classification cleanouts in earth or unpaved foot-traffic areas.
  2. Use medium-duty, top-loading classification cleanouts in paved foot-traffic areas.
  3. Use heavy-duty, top-loading classification cleanouts in vehicle-traffic service areas.
  4. Use extra-heavy-duty, top-loading classification cleanouts in roads.
- B. Set cleanout frames and covers in earth in cast-in-place-concrete block, 18 by 18 by 12 inches deep. Set with tops 1 inch (25 mm) above surrounding grade in lawn areas.
- C. Set cleanout frames and covers in pavement with tops flush with pavement surface.

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### 3.5 MANHOLE INSTALLATION

- A. General: Install manholes, complete with appurtenances and accessories indicated.
- B. Install precast concrete manhole sections with sealants according to ASTM C 891.
- C. Set tops of frames and covers flush with finished surface of manholes that occur in pavements. Set tops 0-1" (0-25 mm) above finished surface elsewhere, unless otherwise indicated.

### 3.6 CATCH BASIN INSTALLATION

- A. Set frames and grates to elevations indicated.
- B. Outlet Control Structure: Provide precast concrete unit, covers, weirs, orifices and appurtenances as shown on the drawings. Provide information on the method, materials, installation, and quality control measures which will be used to seal the wall between the inlet and outlet side of the manhole.

Precast Tanks, Vaults and Appurtenances: Precast tanks, vaults, and appurtenances shall be constructed of precast reinforced concrete with inside dimensions conforming to those indicated on the contract drawings and conforming to ASTM C478. The tank may be a monolithic section or constructed with tongue and grooves with approved watertight sealants such as butyl sealant. All penetrations through the tank shall use either cast in place wall sleeves with Link Seals or a flexible boot secured in the casting such as Kor N Seal. Any clamps or metallic connections shall be stainless steel.

The tanks, vaults, and appurtenances shall include shop drawings and submittals with supporting computations which demonstrate the tank can support an H<sub>2</sub>O loading, an equivalent external fluid pressure of 105 lb./cubic ft. (with the tank empty), and an internal fluid pressure of 65 lb./cubic ft. The pressures shall be assumed to apply from the base of the structure to the finish grade surface.

Tanks which require attachment to an anti-flotation slab shall use stainless steel angles and anchors sized to resist the uplift force.

The tanks shall be coated with a waterproof seal on the interior and exterior. Sections shall be fabricated to receive a watertight seal.

### 3.7 MANHOLES

- A. General: All appurtenant structures shall be set level on compacted material as specified in Section 2 of these Specifications and as shown on the Plans.
- B. Manhole Channels: Channels shall be constructed in all sanitary sewer and storm drain manholes in accordance with the details shown on the Plans by a mason whose qualifications meet the approval of the Engineer or a preformed manhole channel: "FIBERLINER" or equal. The sides shall be raised by brick masonry construction from the spring line perpendicular to the height of the crown of the pipe. Where changes in directions are made at manholes, the

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invert shall be shaped with as great a radius as possible, and to the complete satisfaction of the Engineer. Brick shall be carefully laid to present a smooth surface as indicated on the Plans and to the satisfaction of the Engineer.

### C. Pipe Connections:

1. Stubs in Manholes: Stubs placed as specified and indicated on the Drawings shall be short pieces cut from the bell ends of appropriate pipe and shall have compatible watertight stoppers. Stubs shall be set accurately to the required line and elevation and encased in the structure masonry as indicated on the Drawings.
2. Wall Sleeves and Castings: Wall sleeves and castings as specified and indicated on the Drawings shall be accurately cast to the required location and elevations as indicated on the Drawings.

### D. Steps: Manhole and appurtenant steps shall be cast in the wall and installed in a straight vertical alignment.

## 3.8 ALTERATIONS TO EXISTING MANHOLES AND CATCH BASINS

- A. Existing manholes and catch basins to be altered shall be reconstructed as indicated on the Plans or as directed by the Engineer. Adjusting to grade or connecting to an existing pipe stub is not considered an alteration.
- B. Alterations covered include, but are not limited to, adjustments to manhole invert channel caused by new pipe connections or removal of existing pipe connections, and removal and plugging of existing catch basin lead and replacing with a new lead connection conforming to the appropriate section of the Specifications contained herein.

## 3.9 ADJUSTING EXISTING MANHOLES AND CATCH BASINS

- A. Existing manholes and catch basins to be adjusted to grade shall be reconstructed to the required grade. The existing frames, grates, and covers shall be re-used unless otherwise directed.
- B. The existing structure shall be dismantled to a sufficient depth to allow reconstruction conforming to the standard details.
- C. Adjustment will take place just prior to placing of surface pavement for adjustments of the frame and cover. Adjustments which require dismantling and reconstruction of the super structure shall be accomplished at the time of subgrade preparation. Pavement which is removed for this adjustment shall be cut square, tack coated, and capped with 2" of bituminous concrete. No separate payment will be made for furnishing the bituminous cap.
- D. Each structure that is adjusted shall be cleaned of accumulated silt, debris, or foreign matter prior to final acceptance of the work.

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### 3.10 ABANDONING EXISTING CATCH BASINS AND MANHOLES

- A. Existing catch basins and manholes designated to be abandoned shall be removed to a depth of one (1) foot below the subgrade line, unless otherwise indicated on the Plans or directed by the Engineer. The existing pipes shall be plugged with concrete and brick masonry and the catch basins and manholes shall be filled with heavy gravel satisfactorily compacted in 9 inch lifts. Prior to backfilling, the sump shall be pumped and cleaned of all water and foreign material.

### 3.11 MANHOLE ADAPTERS

- A. When altering an existing manhole or where a pre manufactured manhole adapter cannot be installed in precast manhole sections, the Contractor shall use a Fernco, or equal, concrete manhole adapter. The adapter shall be designed to provide a positive, watertight seal between the manhole and pipe and shall be mortared in place with Five Star grout or approved equal non-shrink grout.

### 3.12 PRECAST TANKS, VAULTS, AND APPURTENANCES

- A. These precast items shall be set in a dry excavation, proof-rolled, and prepared with one of the following bedding materials:

- Compacted  $\frac{3}{4}$ " crushed stone (8" min.)
- Compacted MDOT 703.06 Type D gravel

If the subgrade is weak and/or unstable, a layer of Mirafi 600X shall be installed between the prepared subgrade and the bedding.

- B. The anti-flotation slab shall be carefully laid out and aligned, and set on the bedding with reinforcement and forms set on a dry excavation site. Concrete shall be poured and protected from inclement weather during the cure period.
- C. Tanks shall be set on the anti-flotation slab when required to resist floatation. Where necessary for plumbness and level, the tank shall be shimmed with a strong slurry grout installed to fill the void space.
- D. Multiple section tanks shall be set in place using approved sealants. Double rows shall be required when joint mastics are used. An approved adhesive primer shall be installed prior to installing the mastics and setting the concrete.
- E. The tank shall be anchored to the anti-flotation slab with approved stainless steel masonry anchors when the anti-flotation slab is required. All anchors shall be inspected by the Contractor to assure the anchor is secure and will provide the required resistance.
- F. After anchorage, the tank excavation shall remain dewatered and backfilled. The backfill shall be brought up uniformly around the tank and compacted in place. Pipe connections shall occur after the tank has been backfilled to the level of the bottom of the pipe bedding. The

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dewatering shall continue until the finish grade around the tank has been reached with the backfill.

- G. Any voids created by removal of sheeting, bracing or shielding shall be filled and recompact.

### 3.13 CONNECTIONS

- A. Connect non pressure, gravity-flow drainage piping to building's storm building drains specified in Division 22 Section "Facility Storm Drainage Piping."
- B. Make connections to existing piping and underground manholes.
  - 1. 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 concrete with 28-day compressive strength of 3000 psi (20.7 MPa).
  - 2. Insulation, when required by the Drawings, shall be Styrofoam SM or TG as manufactured by the Dow Chemical Company or equal.
  - 3. Material submitted shall have a K factor of .20 @ 75 degrees by ASTM C518-70, 2-lb. density by ASTM C303-56, compressive strength of 30-lb. by ASTM D1621-64 and a water absorption of less than .05% by ASTM C272-53 and meet Federal Specification HH1524B Type II, Class B.
  - 4. The Contractor shall coat the insulation material in accordance with the manufacturer's instructions.

### 3.14 FIELD QUALITY CONTROL

- A. 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 Project.
  - 1. Submit separate report for each system inspection.
    - a. Horizontal Alignment: Less than full diameter of inside of pipe is visible between structures or ½" off design alignment.
    - b. Deflection: Flexible piping with deflection that prevents passage of ball or cylinder of size not less than 92.5 percent of piping diameter.
    - c. Crushed, broken, cracked, or otherwise damaged piping.
    - d. Infiltration: Water leakage into piping.
    - e. Exfiltration: Water leakage from or around piping.
    - f. Vertical Alignment: Within ¼" of design grade.
  - 2. Replace defective piping using new materials, and repeat inspections until defects are within allowances specified.
  - 3. Re-inspect and repeat procedure until results are satisfactory.

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- B. Test new watertight piping systems that have been installed below the elevation of the permanent pool in the wet pond.
  - 1. Do not enclose, cover, or put into service before inspection and approval.
  - 2. Test completed piping systems according to requirements of authorities having jurisdiction.
  - 3. Schedule tests and inspections by authorities having jurisdiction with at least 24 hours' advance notice.
  - 4. Submit separate report for each test.
  - 5. Air Tests: Test storm drainage according to requirements of authorities having jurisdiction, UNI-B-6, and the following:
    - a. Option: Test plastic gravity sewer piping according to ASTM F 1417.
- C. Leaks and loss in test pressure constitute defects that must be repaired.
- D. Replace leaking piping using new materials, and repeat testing until leakage is within allowances specified.

**END OF SECTION**



**SECTION 33 46 00**

**SUBDRAINAGE**

**PART 1 - GENERAL**

1.1 SECTION INCLUDES

- A. This Section includes subdrainage systems for the building underdrains.
- B. This section also includes subdrainage within the pavement and lawn areas as shown on the contract drawings.

1.2 SUBMITTALS

- A. Submit under provisions of Division 1.
- B. Product Data: For each type of drainage panel or piping indicated on the drawings.

**PART 2 - PRODUCTS**

2.1 PIPING MATERIALS

- A. Refer to the "Piping Applications" Article in Part 3 for applications of pipe, fitting, and joining materials.

2.2 PERFORATED-WALL PIPES AND FITTINGS

- A. Perforated PE Pipe and Fittings: ASTM F 405 or AASHTO M 252, Type CP; corrugated, for coupled joints.
  - 1. Couplings: Manufacturer's standard, band type.
- B. Perforated PVC Sewer Pipe and Fittings: ASTM D 2729, bell-and-spigot ends, for loose joints.

2.3 SOLID-WALL PIPES AND FITTINGS

- A. PE Drainage Tubing and Fittings: AASHTO M 252, Type S, corrugated, with smooth waterway, for coupled joints.
  - 1. Couplings: AASHTO M 252, corrugated, band type, matching tubing and fittings.

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B. PVC Sewer Pipe and Fittings: ASTM D 3034, SDR 35, bell-and-spigot ends, for gasketed joints.

1. Gaskets: ASTM F 477, elastomeric seal.

### 2.4 SPECIAL PIPE COUPLINGS – VACANT

### 2.5 CLEANOUTS

A. Cast-Iron Cleanouts: ASME A112.36.2M; with round-flanged, cast-iron housing; and secured, scoriated, Medium-Duty Loading class, cast-iron cover. Include cast-iron ferrule and countersunk, brass cleanout plug.

### 2.6 SOIL MATERIALS

A. Backfill, drainage course, impervious fill, and satisfactory soil materials are specified in Section 31 20 00 "Earth Moving".

### 2.7 GEOTEXTILE FILTER FABRICS

A. Description: Fabric of PP or polyester fibers or combination of both, with flow rate range from 110 to 330 gpm/sq. ft. (4480 to 13 440 L/min. per sq. m) when tested according to ASTM D 4491.

### 2.8 FLAT PANEL UNDERDRAINS

A. Flat Underdrains shall be ADS material wrapped in fabric. ADS Advanedge or equal shall be used. The flat drain underdrain shall be twelve inches in width and installed vertically. Flat panel underdrains shall be installed with the top flush with finish grade at any location where the finish grade is above the weep holes at the building face.

## PART 3 - EXECUTION

### 3.1 EARTHWORK

A. Excavating, trenching, and backfilling are specified in Section 31 20 00 "Earth Moving".

### 3.2 PIPING APPLICATIONS

A. Underground Subdrainage Piping:

1. Perforated PVC sewer pipe and fittings for loose, bell-and-spigot joints.

B. Underslab Subdrainage Piping:

1. Perforated PVC sewer pipe and fittings and loose, bell-and-spigot joints.

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- C. Header Piping:
  - 1. PE drainage tubing and fittings, couplings, and coupled joints.
  - 2. PVC sewer pipe and fittings, couplings, and coupled joints.

### 3.3 CLEANOUT APPLICATIONS

- A. In Underground Subdrainage Piping:
  - 1. At Grade in Earth: PVC cleanouts.
  - 2. At Grade in Paved or Walkway Areas: Cast-iron cleanouts.

### 3.4 FOUNDATION DRAINAGE AND UNDERDRAIN INSTALLATION

- A. Install underdrainage system at locations shown on the Drawings. Lay pipe with the invert positioned down with invert elevation as shown on the Drawings.
- B. Completely surround the underdrains pipes with a minimum of 6 inches of  $\frac{3}{4}$ " crushed stone and geotextile fabric. Place pipe with joints tightly closed in accordance with manufacturer's recommendations so that flow lines conform to required grades. For perforated collector pipe, lay pipe with perforations down.
- C. Any sections of piping that are not true to lines and grades, or that show any undue settlement after being laid, or are damaged will be removed and re-laid or replaced at no additional cost.
- D. Test or check lines before backfilling to assure free flow. Remove obstructions, replace damaged components, and retest system until satisfactory.
- E. Provide cleanouts for drainage piping at changes of direction, bend of lines, and wherever indicated on the drawings, and necessary to enable system to be cleaned out. Extend cleanouts to finished grade and provide surface protection. Coordinate cleanout locations with structural and architectural improvements.
- F. Install gaskets, seals, sleeves, and couplings according to manufacturer's written instructions and other requirements indicated.
- G. Use increasers, reducers, and couplings made for different sizes or materials of pipes and fittings being connected. Reduction of pipe size in direction of flow is prohibited.
- H. Install PVC piping according to ASTM D 2321.

### 3.5 PIPE JOINT CONSTRUCTION

- A. Join PVC pipe and fittings according to ASTM D 3034 with elastomeric seal gaskets according to ASTM D 2321.
- B. Join perforated PVC pipe and fittings according to ASTM D 2729, with loose bell-and-spigot joints.

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- C. Special Pipe Couplings: Join piping made of different materials and dimensions with special couplings made for this application. Use couplings that are compatible with and fit materials and dimensions of both pipes.

### 3.6 CLEANOUT INSTALLATION

#### A. Cleanouts for Subdrainage:

1. Install cleanouts from piping to grade. Locate cleanouts at beginning of piping run and at changes in direction. Install fittings so cleanouts open in direction of flow in piping.
2. In vehicular-traffic areas, use NPS 4 (DN 100) cast-iron soil pipe and fittings for piping branch fittings and riser extensions to cleanout. Set cleanout frames and covers in a cast-in-place concrete anchor, 18 by 18 by 12 inches (450 by 450 by 300 mm) in depth. Set top of cleanout flush with grade. Cast-iron pipe may also be used for cleanouts in non-vehicular-traffic areas.
3. In non vehicular-traffic areas, use NPS 4 (DN 100) cast-iron pipe and fittings for piping branch fittings and riser extensions to cleanout. Set cleanout frames and covers in a cast-in-place concrete anchor, 12 by 12 by 4 inches (300 by 300 by 100 mm) in depth. Set top of cleanout plug 1 inch (25 mm) above grade.

### 3.7 CONNECTIONS

- A. Drawings indicate general arrangement of piping, fittings, and specialties.
- B. Connect low elevations of subdrainage system to building's solid-wall-piping storm drainage system.
- C. Where required, connect low elevations of foundation underslab subdrainage to stormwater sump pumps.

### 3.8 FIELD QUALITY CONTROL

- A. Testing: After installing drainage course to top of piping, test drain piping with water to ensure free flow before backfilling. Remove obstructions, replace damaged components, and repeat test until results are satisfactory.

### 3.9 CLEANING

- A. Clear interior of installed piping and structures of dirt and other superfluous material as work progresses. Maintain swab or drag in piping and pull past each joint as it is completed. Place plugs in ends of uncompleted pipe at end of each day or when work stops.

**END OF SECTION**

SECTION 03300

CAST-IN-PLACE CONCRETE

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. This Section specifies cast-in place concrete, including formwork, reinforcement, concrete materials, mixture design, placement procedures, and finishes, for the following:
  - 1. Footings.
  - 2. Foundation walls.
  - 3. Pile Caps
  - 4. Grade Beams
  - 5. Slabs-on-grade
  - 6. Slabs-on-metal deck.
- B. Related Sections include the following:
  - 1. Division 2 Section "Earthwork" for drainage fill under slabs-on-grade.

1.3 DEFINITIONS

- A. Cementitious Materials: Portland cement alone or in combination with one or more of the following: blended hydraulic cement, fly ash and other pozzolans, ground granulated blast-furnace slag, and silica fume; subject to compliance with requirements.

1.4 SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Design Mixtures: For each concrete mixture. Submit alternate design mixtures when characteristics of materials, Project conditions, weather, test results, or other circumstances warrant adjustments.
  - 1. Indicate amounts of mixing water to be withheld for later addition at Project site.
- C. Steel Reinforcement Shop Drawings: Placing drawings that detail fabrication, bending, and placement. Include bar sizes, lengths, material, grade, bar schedules, stirrup spacing, bent bar

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diagrams, bar arrangement, splices and laps, mechanical connections, tie spacing, hoop spacing, and supports for concrete reinforcement.

- D. Material Test Reports: For the following, from a qualified testing agency, indicating compliance with requirements:
  - 1. Aggregates. Include service record data indicating absence of deleterious expansion of concrete due to alkali aggregate reactivity.
- E. Material Certificates: For each of the following, signed by manufacturers:
  - 1. Cementitious materials.
  - 2. Admixtures.
  - 3. Curing compounds.
  - 4. Floor and slab treatments.
- F. Floor surface flatness and levelness measurements to determine compliance with specified tolerances.
- G. Field quality-control test and inspection reports.
- H. Minutes of preinstallation conference.

### 1.5 QUALITY ASSURANCE

- A. Installer Qualifications: A qualified installer who employs on Project personnel qualified as ACI-certified Flatwork Technician and Finisher and a supervisor who is an ACI-certified Concrete Flatwork Technician.
- B. Manufacturer Qualifications: A firm experienced in manufacturing ready-mixed concrete products and that complies with ASTM C 94/C 94M requirements for production facilities and equipment.
  - 1. Manufacturer certified according to NRMCA's "Certification of Ready Mixed Concrete Production Facilities."
- C. Testing Agency Qualifications: An independent agency, acceptable to engineer of record qualified according to ASTM C 1077 and ASTM E 329 for testing indicated, as documented according to ASTM E 548.
  - 1. Personnel conducting field tests shall be qualified as ACI Concrete Field Testing Technician, Grade 1, according to ACI CP-01 or an equivalent certification program.
  - 2. Personnel performing laboratory tests shall be ACI-certified Concrete Strength Testing Technician and Concrete Laboratory Testing Technician - Grade I. Testing Agency laboratory supervisor shall be an ACI-certified Concrete Laboratory Testing Technician - Grade II.
- D. Source Limitations: Obtain each type or class of cementitious material of the same brand from the same manufacturer's plant, obtain aggregate from one source, and obtain admixtures through one source from a single manufacturer.

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- E. ACI Publications: Comply with the following unless modified by requirements in the Contract Documents:
  - 1. ACI 301, "Specification for Structural Concrete," Sections 1 through 5.
  - 2. ACI 117, "Specifications for Tolerances for Concrete Construction and Materials."
- F. Concrete Testing Service: Engage a qualified independent testing agency to perform material evaluation tests and to design concrete mixtures.
- G. Preinstallation Conference: Conduct conference at Project site to comply with requirements in Division 1 Section "Project Management and Coordination."
  - 1. Before submitting design mixtures, review concrete design mixture and examine procedures for ensuring quality of concrete materials. Require representatives of each entity directly concerned with cast-in-place concrete to attend, including the following:
    - a. Contractor's superintendent.
    - b. Independent testing agency responsible for concrete design mixtures.
    - c. Ready-mix concrete manufacturer.
    - d. Concrete subcontractor.
  - 2. Review special inspection and testing and inspecting agency procedures for field quality control, concrete finishes and finishing, cold- and hot-weather concreting procedures, curing procedures, construction contraction and isolation joints, and joint-filler strips, semirigid joint fillers, vapor-retarder installation, floor and slab flatness and levelness measurement, concrete repair procedures, and concrete protection.

### 1.6 DELIVERY, STORAGE, AND HANDLING

- A. Steel Reinforcement: Deliver, store, and handle steel reinforcement to prevent bending and damage.
- B. Waterstops: Store waterstops under cover to protect from moisture, sunlight, dirt, oil, and other contaminants.

## PART 2 - PRODUCTS

### 2.1 MANUFACTURERS

- A. In other Part 2 articles where titles below introduce lists, the following requirements apply to product selection:
  - 1. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, products specified.
  - 2. Products: Subject to compliance with requirements, provide one of the products specified.

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3. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, manufacturers specified.
4. Manufacturers: Subject to compliance with requirements, provide products by one of the manufacturers specified.

### 2.2 FORM-FACING MATERIALS

- A. Smooth-Formed Finished Concrete: Form-facing panels that will provide continuous, true, and smooth concrete surfaces. Furnish in largest practicable sizes to minimize number of joints.
  1. Plywood, metal, or other approved panel materials.
  2. Exterior-grade plywood panels, suitable for concrete forms, complying with DOC PS 1, and as follows:
    - a. High-density overlay, Class 1 or better.
    - b. Medium-density overlay, Class 1 or better; mill-release agent treated and edge sealed.
    - c. Structural 1, B-B or better; mill oiled and edge sealed.
    - d. B-B (Concrete Form), Class 1 or better; mill oiled and edge sealed.
- B. Rough-Formed Finished Concrete: Plywood, lumber, metal, or another approved material. Provide lumber dressed on at least two edges and one side for tight fit.
- C. Forms for Cylindrical Columns, Pedestals, and Supports: Metal, glass-fiber-reinforced plastic, paper, or fiber tubes that will produce surfaces with gradual or abrupt irregularities not exceeding specified formwork surface class. Provide units with sufficient wall thickness to resist plastic concrete loads without detrimental deformation.
- D. Pan-Type Forms: Glass-fiber-reinforced plastic or formed steel, stiffened to resist plastic concrete loads without detrimental deformation.
- E. Void Forms: Biodegradable paper surface, treated for moisture resistance, structurally sufficient to support weight of plastic concrete and other superimposed loads.
- F. Chamfer Strips: Wood, metal, PVC, or rubber strips, 3/4 by 3/4 inch (19 by 19 mm), minimum.
- G. Rustication Strips: Wood, metal, PVC, or rubber strips, kerfed for ease of form removal.
- H. Form-Release Agent: Commercially formulated form-release agent that will not bond with, stain, or adversely affect concrete surfaces and will not impair subsequent treatments of concrete surfaces.
  1. Formulate form-release agent with rust inhibitor for steel form-facing materials.
- I. Form Ties: Factory-fabricated, removable or snap-off metal or glass-fiber-reinforced plastic form ties designed to resist lateral pressure of fresh concrete on forms and to prevent spalling of concrete on removal.



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1. Furnish units that will leave no corrodible metal closer than 1 inch (25 mm) to the plane of exposed concrete surface.
2. Furnish ties that, when removed, will leave holes no larger than 1 inch (25 mm) in diameter in concrete surface.
3. Furnish ties with integral water-barrier plates to walls indicated to receive dampproofing or waterproofing.

### 2.3 STEEL REINFORCEMENT

- A. Reinforcing Bars: ASTM A 615/A 615M, Grade 60 (Grade 420), deformed.
- B. Plain-Steel Wire: ASTM A 82, as drawn.
- C. Deformed-Steel Wire: ASTM A 496.
- D. Plain-Steel Welded Wire Reinforcement: ASTM A 185, plain, fabricated from as-drawn steel wire into flat sheets.
- E. Deformed-Steel Welded Wire Reinforcement: ASTM A 497, flat sheet.

### 2.4 REINFORCEMENT ACCESSORIES

- A. Joint Dowel Bars: ASTM A 615/A 615M, Grade 60 (Grade 420), plain-steel bars, cut bars true to length with ends square and free of burrs.
- B. Bar Supports: Bolsters, chairs, spacers, and other devices for spacing, supporting, and fastening reinforcing bars and welded wire reinforcement in place. Manufacture bar supports from steel wire, plastic, or precast concrete according to CRSI's "Manual of Standard Practice," of greater compressive strength than concrete and as follows:
  1. For concrete surfaces exposed to view where legs of wire bar supports contact forms, use CRSI Class 1 plastic-protected steel wire or CRSI Class 2 stainless-steel bar supports.
  2. For epoxy-coated reinforcement, use epoxy-coated or other dielectric-polymer-coated wire bar supports.
  3. For zinc-coated reinforcement, use galvanized wire or dielectric-polymer-coated wire bar supports.

### 2.5 CONCRETE MATERIALS

- A. Cementitious Material: Use the following cementitious materials, of the same type, brand, and source, throughout Project:
  1. Portland Cement: ASTM C 150, Type I or II, gray. Can be supplemented with the following:
    - a. Fly Ash: ASTM C 618, Class C.
- B. Silica Fume: ASTM C 1240, amorphous silica.

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- C. Normal-Weight Aggregates: ASTM C 33, Class 3S coarse aggregate or better, graded. Provide aggregates from a single source.
  - 1. Maximum Coarse-Aggregate Size: 1 inch (25 mm) nominal.
  - 2. Fine Aggregate: Free of materials with deleterious reactivity to alkali in cement.
- D. Lightweight Aggregate: ASTM C 330, 3/4-inch (19-mm) nominal maximum aggregate size.
- E. Water: ASTM C 94/C 94M and potable.

### 2.6 ADMIXTURES

- A. Air-Entraining Admixture: ASTM C 260.
- B. Chemical Admixtures: Provide admixtures certified by manufacturer to be compatible with other admixtures and that will not contribute water-soluble chloride ions exceeding those permitted in hardened concrete. Do not use calcium chloride or admixtures containing calcium chloride.
  - 1. Water-Reducing Admixture: ASTM C 494/C 494M, Type A.
  - 2. Retarding Admixture: ASTM C 494/C 494M, Type B.
  - 3. Water-Reducing and Retarding Admixture: ASTM C 494/C 494M, Type D.
  - 4. High-Range, Water-Reducing Admixture: ASTM C 494/C 494M, Type F.

### 2.7 WATERSTOPS

- A. Self-Expanding Butyl Strip Waterstops: Manufactured rectangular or trapezoidal strip, butyl rubber with sodium bentonite or other hydrophilic polymers, for adhesive bonding to concrete, 3/4 by 1 inch (19 by 25 mm).
  - 1. Products:
    - a. Colloid Environmental Technologies Company; Volclay Waterstop-RX.
    - b. Concrete Sealants Inc.; Conseal CS-231.
    - c. Greenstreak; Swellstop.
    - d. Henry Company, Sealants Division; Hydro-Flex.
    - e. JP Specialties, Inc.; Earthshield Type 20.
    - f. Progress Unlimited, Inc.; Superstop.
    - g. TCMiraDRI; Mirastop.

### 2.8 VAPOR RETARDERS

- A. Plastic Vapor Retarder: ASTM E 1745, Class A 15 mil minimum thickness. Include manufacturer's recommended adhesive or pressure-sensitive tape.
  - 1. Products:

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- a. Fortifiber Corporation; Moistop Ultra A.
  - b. Raven Industries Inc.; Vapor Block .
  - c. Reef Industries, Inc.; Griffolyn .
  - d. Stego Industries, LLC; Stego Wrap.
- B. Granular Fill: Clean mixture of crushed stone or crushed or uncrushed gravel; ASTM D 448, Size 57, with 100 percent passing a 1-1/2-inch (37.5-mm) sieve and 0 to 5 percent passing a No. 8 (2.36-mm) sieve.
- C. Fine-Graded Granular Material: Clean mixture of crushed stone, crushed gravel, and manufactured or natural sand; ASTM D 448, Size 10, with 100 percent passing a 3/8-inch (9.5-mm) sieve, 10 to 30 percent passing a No. 100 (0.15-mm) sieve, and at least 5 percent passing No. 200 (0.075-mm) sieve; complying with deleterious substance limits of ASTM C 33 for fine aggregates.

### 2.9 CURING MATERIALS

- A. Absorptive Cover: AASHTO M 182, Class 2, burlap cloth made from jute or kenaf, weighing approximately 9 oz./sq. yd. (305 g/sq. m) when dry.
- B. Moisture-Retaining Cover: ASTM C 171, polyethylene film or white burlap-polyethylene sheet.
- C. Water: Potable.
- D. Clear, Waterborne, Membrane-Forming Curing Compound: ASTM C 309, Type 1, Class B, dissipating. For use on elevated slabs.
1. Products:
    - a. Anti-Hydro International, Inc.; AH Curing Compound #2 DR WB.
    - b. Burke by Edoco; Aqua Resin Cure.
    - c. ChemMasters; Safe-Cure Clear.
    - d. Conspec Marketing & Manufacturing Co., Inc., a Dayton Superior Company; W.B. Resin Cure.
    - e. Dayton Superior Corporation; Day Chem Rez Cure (J-11-W).
    - f. Euclid Chemical Company (The); Kurez DR VOX.
    - g. Kaufman Products, Inc.; Thinfilm 420.
    - h. Lambert Corporation; Aqua Kure-Clear.
    - i. L&M Construction Chemicals, Inc.; L&M Cure R.
    - j. Meadows, W. R., Inc.; 1100 Clear.
    - k. Nox-Crete Products Group, Kinsman Corporation; Resin Cure E.
    - l. Symons Corporation, a Dayton Superior Company; Resi-Chem Clear Cure.
    - m. Tamms Industries, Inc.; Horncure WB 30.
    - n. Unitex; Hydro Cure 309.
    - o. US Mix Products Company; US Spec Maxcure Resin Clear.
    - p. Vexcon Chemicals, Inc.; Certi-Vex Enviocure 100.

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### 2.10 RELATED MATERIALS

- A. Expansion- and Isolation-Joint-Filler Strips: ASTM D 1751, asphalt-saturated cellulosic fiber.
- B. Semirigid Joint Filler: Two-component, semirigid, 100 percent solids, epoxy resin with a Type A shore durometer hardness of 80 per ASTM D 2240.
- C. Bonding Agent: ASTM C 1059, Type II, non-redispersible, acrylic emulsion or styrene butadiene.
- D. Reglets: Fabricate reglets of not less than 0.0217-inch- (0.55-mm-) thick, galvanized steel sheet. Temporarily fill or cover face opening of reglet to prevent intrusion of concrete or debris.
- E. Dovetail Anchor Slots: Hot-dip galvanized steel sheet, not less than 0.0336 inch (0.85 mm) thick, with bent tab anchors. Temporarily fill or cover face opening of slots to prevent intrusion of concrete or debris.

### 2.11 REPAIR MATERIALS

### 2.12 CONCRETE MIXTURES, GENERAL

- A. Prepare design mixtures for each type and strength of concrete, proportioned on the basis of laboratory trial mixture or field test data, or both, according to ACI 301.
  - 1. Use a qualified independent testing agency for preparing and reporting proposed mixture designs based on laboratory trial mixtures.
- B. Cementitious Materials: Limit percentage, by weight, of cementitious materials other than portland cement in concrete as follows:
  - 1. Fly Ash: 25 percent.
- C. Limit water-soluble, chloride-ion content in hardened concrete to 0.06 percent by weight of cement.
- D. Admixtures: Use admixtures according to manufacturer's written instructions.
  - 1. Use water-reducing admixture in concrete, as required, for placement and workability.
  - 2. Use water-reducing and retarding admixture when required by high temperatures, low humidity, or other adverse placement conditions.
  - 3. Use water-reducing admixture in pumped concrete, concrete for heavy-use industrial slabs and parking structure slabs, concrete required to be watertight, and concrete with a water-cementitious materials ratio below 0.50.
  - 4. Use corrosion-inhibiting admixture in concrete mixtures where indicated.
- E. Color Pigment: Add color pigment to concrete mixture according to manufacturer's written instructions and to result in hardened concrete color consistent with approved mockup.

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### 2.13 CONCRETE MIXTURES FOR BUILDING ELEMENTS

- A. Footings, pile caps, grade beams and foundation walls: Proportion normal-weight concrete mixture as follows:
1. Minimum Compressive Strength: 3000 psi (20.7 MPa) at 28 days.
  2. Maximum Water-Cementitious Materials Ratio: 0.50.
  3. Slump Limit: 4 inches (100 mm) for concrete before adding water-reducing admixture, plus or minus 1 inch (25 mm).
  4. Air Content: 6 percent, plus or minus 1.5 percent at point of delivery for 1-inch (25-mm) nominal maximum aggregate size.
- B. Interior Slabs-on-Grade: Proportion normal-weight concrete mixture as follows:
1. Minimum Compressive Strength: 3500 psi (20.7 MPa) at 28 days.
  2. Slump Limit: 4 inches (100 mm), plus or minus 1 inch (25 mm).
  3. Air Content: 1 percent, plus or minus 1.5 percent at point of delivery.
  4. Air Content: Do not allow air content of troweled finished floors to exceed 3 percent.
- C. Exterior Slabs-on-Grade: Proportion normal-weight concrete mixture as follows:
1. Minimum Compressive Strength: 4500 psi (27.6 MPa) at 28 days.
  2. Slump Limit: 4 inches (100 mm), plus or minus 1 inch (25 mm).
  3. Air Content: 6 percent, plus or minus 1.5 percent at point of delivery for 1-inch (25-mm) nominal maximum aggregate size.
- D. Suspended Slabs: Proportion light-weight concrete mixture as follows:
1. Minimum Compressive Strength: 3500 psi (24.1 MPa) at 28 days.
  2. Slump Limit: 4 inches (100 mm), plus or minus 1 inch (25 mm) prior to the addition of a water reducing admixture..
  3. Air Content: Do not allow air content of troweled finished floors to exceed 3 percent.

### 2.14 FABRICATING REINFORCEMENT

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

### 2.15 CONCRETE MIXING

- A. Ready-Mixed Concrete: Measure, batch, mix, and deliver concrete according to ASTM C 94/C 94M and ASTM C 1116, and furnish batch ticket information.
1. When air temperature is between 85 and 90 deg F (30 and 32 deg C), reduce mixing and delivery time from 1-1/2 hours to 75 minutes; when air temperature is above 90 deg F (32 deg C), reduce mixing and delivery time to 60 minutes.

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### PART 3 - EXECUTION

#### 3.1 FORMWORK

- A. Design, erect, shore, brace, and maintain formwork, according to ACI 301, to support vertical, lateral, static, and dynamic loads, and construction loads that might be applied, until structure can support such loads.
- B. Construct formwork so concrete members and structures are of size, shape, alignment, elevation, and position indicated, within tolerance limits of ACI 117.
- C. Limit concrete surface irregularities, designated by ACI 347R as abrupt or gradual, as follows:
  - 1. Class A, 1/8 inch (3.2 mm) for smooth-formed finished surfaces.
  - 2. Class C, 1/2 inch (13 mm) for rough-formed finished surfaces.
- D. Construct forms tight enough to prevent loss of concrete mortar.
- E. Fabricate forms for easy removal without hammering or prying against concrete surfaces. Provide crush or wrecking plates where stripping may damage cast concrete surfaces. Provide top forms for inclined surfaces steeper than 1.5 horizontal to 1 vertical.
  - 1. Install keyways, reglets, recesses, and the like, for easy removal.
  - 2. Do not use rust-stained steel form-facing material.
- F. Set edge forms, bulkheads, and intermediate screed strips for slabs to achieve required elevations and slopes in finished concrete surfaces. Provide and secure units to support screed strips; use strike-off templates or compacting-type screeds.
- G. Provide temporary openings for cleanouts and inspection ports where interior area of formwork is inaccessible. Close openings with panels tightly fitted to forms and securely braced to prevent loss of concrete mortar. Locate temporary openings in forms at inconspicuous locations.
- H. Do not chamfer exterior corners and edges of permanently exposed concrete.
- I. Form openings, chases, offsets, sinkages, keyways, reglets, blocking, screeds, and bulkheads required in the Work. Determine sizes and locations from trades providing such items.
- J. Clean forms and adjacent surfaces to receive concrete. Remove chips, wood, sawdust, dirt, and other debris just before placing concrete.
- K. Retighten forms and bracing before placing concrete, as required, to prevent mortar leaks and maintain proper alignment.
- L. Coat contact surfaces of forms with form-release agent, according to manufacturer's written instructions, before placing reinforcement.

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### 3.2 EMBEDDED ITEMS

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

### 3.3 REMOVING AND REUSING FORMS

- A. General: Formwork for sides of beams, walls, columns, and similar parts of the Work that does not support weight of concrete may be removed after cumulatively curing at not less than 50 deg F (10 deg C) for 24 hours after placing concrete, if concrete is hard enough to not be damaged by form-removal operations and curing and protection operations are maintained.
  - 1. Leave formwork for beam soffits, joists, slabs, and other structural elements that supports weight of concrete in place until concrete has achieved at least 70 percent of its 28-day design compressive strength.
  - 2. Remove forms only if shores have been arranged to permit removal of forms without loosening or disturbing shores.
- B. Clean and repair surfaces of forms to be reused in the Work. Split, frayed, delaminated, or otherwise damaged form-facing material will not be acceptable for exposed surfaces. Apply new form-release agent.
- C. When forms are reused, clean surfaces, remove fins and laitance, and tighten to close joints. Align and secure joints to avoid offsets. Do not use patched forms for exposed concrete surfaces unless approved by Architect.

### 3.4 VAPOR RETARDERS

- A. Plastic Vapor Retarders: Place, protect, and repair vapor retarders according to ASTM E 1643 and manufacturer's written instructions.
  - 1. Lap joints 6 inches (150 mm) and seal with manufacturer's recommended tape.
- B. Bituminous Vapor Retarders: Place, protect, and repair vapor retarders according to manufacturer's written instructions.

### 3.5 STEEL REINFORCEMENT

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

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1. Do not cut or puncture vapor retarder. Repair damage and reseal vapor retarder before placing concrete.
- B. Clean reinforcement of loose rust and mill scale, earth, ice, and other foreign materials that would reduce bond to concrete.
- C. Accurately position, support, and secure reinforcement against displacement. Locate and support reinforcement with bar supports to maintain minimum concrete cover. Do not tack weld crossing reinforcing bars.
  1. Weld reinforcing bars according to AWS D1.4, where indicated.
- D. Set wire ties with ends directed into concrete, not toward exposed concrete surfaces.
- E. Install welded wire reinforcement in longest practicable lengths on bar supports spaced to minimize sagging. Lap edges and ends of adjoining sheets at least one mesh spacing. Offset laps of adjoining sheet widths to prevent continuous laps in either direction. Lace overlaps with wire.

### 3.6 JOINTS

- A. General: Construct joints true to line with faces perpendicular to surface plane of concrete.
- B. Construction Joints: Install so strength and appearance of concrete are not impaired, at locations indicated or as approved by Architect.
  1. Place joints perpendicular to main reinforcement. Continue reinforcement across construction joints, unless otherwise indicated. Do not continue reinforcement through sides of strip placements of floors and slabs.
  2. Form keyed joints as indicated. Embed keys at least 1-1/2 inches (38 mm) into concrete.
  3. Locate joints for slabs in the middle third of spans.
  4. Locate horizontal joints in walls at underside of floor slabs.
  5. Space vertical joints in walls as indicated. Locate joints beside piers integral with walls, near corners, and in concealed locations where possible.
  6. Use a bonding agent at locations where fresh concrete is placed against hardened or partially hardened concrete surfaces.
- C. Contraction Joints in Slabs-on-Grade: Form weakened-plane contraction joints, sectioning concrete into areas as indicated. Construct contraction joints for a depth equal to at least one-fourth of concrete thickness as follows:
  1. Grooved Joints: For Exterior sidewalk slabs form contraction joints after initial floating by grooving and finishing each edge of joint to a radius of 1/8 inch (3.2 mm). Repeat grooving of contraction joints after applying surface finishes. Eliminate groover tool marks on concrete surfaces.
  2. Sawed Joints: Form contraction joints with power saws equipped with shatterproof abrasive or diamond-rimmed blades. Cut 1/8-inch- (3.2-mm-) wide joints into concrete when cutting action will not tear, abrade, or otherwise damage surface and before concrete develops random contraction cracks.



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- D. Isolation Joints in Slabs-on-Grade: After removing formwork, install joint-filler strips at slab junctions with vertical surfaces, such as column pedestals, foundation walls, grade beams, and other locations, as indicated.
  - 1. Extend joint-filler strips full width and depth of joint, terminating flush with finished concrete surface, unless otherwise indicated.
  - 2. Terminate full-width joint-filler strips not less than 1/2 inch (13 mm) or more than 1 inch (25 mm) below finished concrete surface where joint sealants, specified in Division 7 Section "Joint Sealants," are indicated.
  - 3. Install joint-filler strips in lengths as long as practicable. Where more than one length is required, lace or clip sections together.
- E. Doweled Joints: Install dowel bars and support assemblies at joints where indicated.

### 3.7 WATERSTOPS

- A. Self-Expanding Strip Waterstops: Install in construction joints and at other locations indicated, according to manufacturer's written instructions, adhesive bonding, mechanically fastening, and firmly pressing into place. Install in longest lengths practicable.

### 3.8 CONCRETE PLACEMENT

- A. Before placing concrete, verify that installation of formwork, reinforcement, and embedded items is complete and that required inspections have been performed.
- B. Do not add water to concrete during delivery, at Project site, or during placement unless approved by Architect.
- C. Before test sampling and placing concrete, water may be added at Project site, subject to limitations of ACI 301.
  - 1. Do not add water to concrete after adding high-range water-reducing admixtures to mixture.
- D. Deposit concrete continuously in one layer or in horizontal layers of such thickness that no new concrete will be placed on concrete that has hardened enough to cause seams or planes of weakness. If a section cannot be placed continuously, provide construction joints as indicated. Deposit concrete to avoid segregation.
  - 1. Deposit concrete in horizontal layers of depth to not exceed formwork design pressures and in a manner to avoid inclined construction joints.
  - 2. Consolidate placed concrete with mechanical vibrating equipment according to ACI 301.
  - 3. Do not use vibrators to transport concrete inside forms. Insert and withdraw vibrators vertically at uniformly spaced locations to rapidly penetrate placed layer and at least 6 inches (150 mm) into preceding layer. Do not insert vibrators into lower layers of concrete that have begun to lose plasticity. At each insertion, limit duration of vibration to time necessary to consolidate concrete and complete embedment of reinforcement and other embedded items without causing mixture constituents to segregate.

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- E. Deposit and consolidate concrete for floors and slabs in a continuous operation, within limits of construction joints, until placement of a panel or section is complete.
  - 1. Consolidate concrete during placement operations so concrete is thoroughly worked around reinforcement and other embedded items and into corners.
  - 2. Maintain reinforcement in position on chairs during concrete placement.
  - 3. Screed slab surfaces with a straightedge and strike off to correct elevations.
  - 4. Slope surfaces uniformly to drains where required.
  - 5. Begin initial floating using bull floats or darbies to form a uniform and open-textured surface plane, before excess bleedwater appears on the surface. Do not further disturb slab surfaces before starting finishing operations.
  
- F. Cold-Weather Placement: Comply with ACI 306.1 and as follows. Protect concrete work from physical damage or reduced strength that could be caused by frost, freezing actions, or low temperatures.
  - 1. When average high and low temperature is expected to fall below 40 deg F (4.4 deg C) for three successive days, maintain delivered concrete mixture temperature within the temperature range required by ACI 301.
  - 2. Do not use frozen materials or materials containing ice or snow. Do not place concrete on frozen subgrade or on subgrade containing frozen materials.
  - 3. Do not use calcium chloride, salt, or other materials containing antifreeze agents or chemical accelerators unless otherwise specified and approved in mixture designs.
  
- G. Hot-Weather Placement: Comply with ACI 301 and as follows:
  - 1. Maintain concrete temperature below 90 deg F (32 deg C) at time of placement. Chilled mixing water or chopped ice may be used to control temperature, provided water equivalent of ice is calculated to total amount of mixing water. Using liquid nitrogen to cool concrete is Contractor's option.
  - 2. Fog-spray forms, steel reinforcement, and subgrade just before placing concrete. Keep subgrade uniformly moist without standing water, soft spots, or dry areas.

### 3.9 FINISHING FORMED SURFACES

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

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

### 3.10 FINISHING FLOORS AND SLABS

- A. General: Comply with ACI 302.1R recommendations for screeding, restraighening, and finishing operations for concrete surfaces. Do not wet concrete surfaces.
- B. Float Finish: Consolidate surface with power-driven floats or by hand floating if area is small or inaccessible to power driven floats. Restraighten, cut down high spots, and fill low spots. Repeat float passes and restraighening until surface is left with a uniform, smooth, granular texture.
1. Apply float finish to surfaces to receive trowel finish.
- C. Trowel Finish: After applying float finish, apply first troweling and consolidate concrete by hand or power-driven trowel. Continue troweling passes and restraighten until surface is free of trowel marks and uniform in texture and appearance. Grind smooth any surface defects that would telegraph through applied coatings or floor coverings.
1. Apply a trowel finish to surfaces to be covered with resilient flooring, carpet, ceramic or quarry tile set over a cleavage membrane, paint, or another thin-film-finish coating system.
  2. Finish surfaces to the following tolerances, according to ASTM E 1155 (ASTM E 1155M), for a randomly trafficked floor surface:
    - a. Specified overall values of flatness, F(F) 30; and of levelness, F(L) 20; with minimum local values of flatness, F(F) 17; and of levelness, F(L) 15 for slabs on grade under concrete toppings and ceramic tile.
    - b. Specified overall values of flatness, F(F) 35; and of levelness, F(L) 25; with minimum local values of flatness, F(F) 24; and of levelness, F(L) 17; for slabs-on-grade exposed to view and under vinyl tile, epoxy coatings, paint and carpet.

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- c. Specified overall values of flatness, F(F) 25; for elevated slabs on steel beams and metal deck (equivalent to ¼" gap under 10-foot straightedge). Elevated slab elevations shall be set by lasers taking in consideration that beams and deck shall deflect due to dead load..
- D. Trowel and Fine-Broom Finish: Apply a first trowel finish to surfaces where ceramic or quarry tile is to be installed by either thickset or thin-set method. While concrete is still plastic, slightly scarify surface with a fine broom.
  - 1. Comply with flatness and levelness tolerances for trowel finished floor surfaces.
- E. Broom Finish: Apply a broom finish to exterior concrete platforms, steps, and ramps, and elsewhere as indicated.
  - 1. Immediately after float finishing, slightly roughen trafficked surface by brooming with fiber-bristle broom perpendicular to main traffic route. Coordinate required final finish with Architect before application.

### 3.11 MISCELLANEOUS CONCRETE ITEMS

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

### 3.12 CONCRETE PROTECTING AND CURING

- A. General: Protect freshly placed concrete from premature drying and excessive cold or hot temperatures. Comply with ACI 306.1 for cold-weather protection and ACI 301 for hot-weather protection during curing.
- B. Evaporation Retarder: Apply evaporation retarder to unformed concrete surfaces if hot, dry, or windy conditions cause moisture loss approaching 0.2 lb/sq. ft. x h (1 kg/sq. m x h) before and during finishing operations. Apply according to manufacturer's written instructions after placing, screeding, and bull floating or darbying concrete, but before float finishing.

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- C. Formed Surfaces: Cure formed concrete surfaces, including underside of beams, supported slabs, and other similar surfaces. If forms remain during curing period, moist cure after loosening forms. If removing forms before end of curing period, continue curing for the remainder of the curing period.
- D. Unformed Surfaces: Begin curing immediately after finishing concrete. Cure unformed surfaces, including floors and slabs, concrete floor toppings, and other surfaces.
- E. Cure concrete according to ACI 308.1, by one or a combination of the following methods:
  - 1. Moisture Curing: Keep surfaces continuously moist for not less than seven days with the following materials:
    - a. Water.
    - b. Continuous water-fog spray.
    - c. Absorptive cover, water saturated, and kept continuously wet. Cover concrete surfaces and edges with 12-inch (300-mm) lap over adjacent absorptive covers.
  - 2. Moisture-Retaining-Cover Curing: Cover concrete surfaces with moisture-retaining cover for curing concrete, placed in widest practicable width, with sides and ends lapped at least 12 inches (300 mm), and sealed by waterproof tape or adhesive. Cure for not less than seven days. Immediately repair any holes or tears during curing period using cover material and waterproof tape.
    - a. Moisture cure or use moisture-retaining covers to cure concrete surfaces to receive floor coverings.
    - b. Moisture cure or use moisture-retaining covers to cure concrete surfaces to receive penetrating liquid floor treatments.
    - c. Cure concrete surfaces to receive floor coverings with either a moisture-retaining cover or a curing compound that the manufacturer certifies will not interfere with bonding of floor covering used on Project..
  - 3. Curing Compound: Apply uniformly in continuous operation by power spray or roller according to manufacturer's written instructions. Recoat areas subjected to heavy rainfall within three hours after initial application. Maintain continuity of coating and repair damage during curing period.
    - a. After curing period has elapsed, remove curing compound without damaging concrete surfaces by method recommended by curing compound manufacturer unless manufacturer certifies curing compound will not interfere with bonding of floor covering used on Project.
  - 4. Curing and Sealing Compound: Apply uniformly to floors and slabs indicated in a continuous operation by power spray or roller according to manufacturer's written instructions. Recoat areas subjected to heavy rainfall within three hours after initial application. Repeat process 24 hours later and apply a second coat. Maintain continuity of coating and repair damage during curing period.

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### 3.13 JOINT FILLING

- A. Prepare, clean, and install joint filler according to manufacturer's written instructions.
  - 1. Defer joint filling until concrete has aged at least one month(s). Do not fill joints until construction traffic has permanently ceased.
- B. Remove dirt, debris, saw cuttings, curing compounds, and sealers from joints; leave contact faces of joint clean and dry.
- C. Install semirigid joint filler full depth in saw-cut joints and at least 2 inches (50 mm) deep in formed joints. Overfill joint and trim joint filler flush with top of joint after hardening.

### 3.14 CONCRETE SURFACE REPAIRS

- A. Defective Concrete: Repair and patch defective areas when approved by Architect. Remove and replace concrete that cannot be repaired and patched to Architect's approval.
- B. Patching Mortar: Mix dry-pack patching mortar, consisting of one part portland cement to two and one-half parts fine aggregate passing a No. 16 (1.18-mm) sieve, using only enough water for handling and placing.
- C. Repairing Formed Surfaces: Surface defects include color and texture irregularities, cracks, spalls, air bubbles, honeycombs, rock pockets, fins and other projections on the surface, and stains and other discolorations that cannot be removed by cleaning.
  - 1. Immediately after form removal, cut out honeycombs, rock pockets, and voids more than 1/2 inch (13 mm) in any dimension in solid concrete, but not less than 1 inch (25 mm) in depth. Make edges of cuts perpendicular to concrete surface. Clean, dampen with water, and brush-coat holes and voids with bonding agent. Fill and compact with patching mortar before bonding agent has dried. Fill form-tie voids with patching mortar or cone plugs secured in place with bonding agent.
  - 2. Repair defects on surfaces exposed to view by blending white portland cement and standard portland cement so that, when dry, patching mortar will match surrounding color. Patch a test area at inconspicuous locations to verify mixture and color match before proceeding with patching. Compact mortar in place and strike off slightly higher than surrounding surface.
  - 3. Repair defects on concealed formed surfaces that affect concrete's durability and structural performance as determined by Architect.
- D. Repairing Unformed Surfaces: Test unformed surfaces, such as floors and slabs, for finish and verify surface tolerances specified for each surface. Correct low and high areas. Test surfaces sloped to drain for trueness of slope and smoothness; use a sloped template.
  - 1. Repair finished surfaces containing defects. Surface defects include spalls, popouts, honeycombs, rock pockets, crazing and cracks in excess of 0.01 inch (0.25 mm) wide or that penetrate to reinforcement or completely through unreinforced sections regardless of width, and other objectionable conditions.
  - 2. After concrete has cured at least 14 days, correct high areas by grinding.

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3. Correct localized low areas during or immediately after completing surface finishing operations by cutting out low areas and replacing with patching mortar. Finish repaired areas to blend into adjacent concrete.
4. Correct other low areas scheduled to receive floor coverings with a repair underlayment. Prepare, mix, and apply repair underlayment and primer according to manufacturer's written instructions to produce a smooth, uniform, plane, and level surface. Feather edges to match adjacent floor elevations.
5. Correct other low areas scheduled to remain exposed with a repair topping. Cut out low areas to ensure a minimum repair topping depth of 1/4 inch (6 mm) to match adjacent floor elevations. Prepare, mix, and apply repair topping and primer according to manufacturer's written instructions to produce a smooth, uniform, plane, and level surface.
6. Repair defective areas, except random cracks and single holes 1 inch (25 mm) or less in diameter, by cutting out and replacing with fresh concrete. Remove defective areas with clean, square cuts and expose steel reinforcement with at least a 3/4-inch (19-mm) clearance all around. Dampen concrete surfaces in contact with patching concrete and apply bonding agent. Mix patching concrete of same materials and mixture as original concrete except without coarse aggregate. Place, compact, and finish to blend with adjacent finished concrete. Cure in same manner as adjacent concrete.
7. Repair random cracks and single holes 1 inch (25 mm) or less in diameter with patching mortar. Groove top of cracks and cut out holes to sound concrete and clean off dust, dirt, and loose particles. Dampen cleaned concrete surfaces and apply bonding agent. Place patching mortar before bonding agent has dried. Compact patching mortar and finish to match adjacent concrete. Keep patched area continuously moist for at least 72 hours.

- E. Perform structural repairs of concrete, subject to Architect's approval, using epoxy adhesive and patching mortar.
- F. Repair materials and installation not specified above may be used, subject to Architect's approval.

### 3.15 FIELD QUALITY CONTROL

- A. Testing and Inspecting: Owner will engage a qualified testing and inspecting agency to perform field tests and inspections and prepare test reports.
- B. Testing and Inspecting: Engage a qualified testing and inspecting agency to perform tests and inspections and to submit reports.
- C. Inspections:
1. Steel reinforcement placement.
  2. Steel reinforcement welding.
  3. Headed bolts and studs.
  4. Verification of use of required design mixture.
  5. Concrete placement, including conveying and depositing.
  6. Curing procedures and maintenance of curing temperature.
  7. Verification of concrete strength before removal of shores and forms from beams and slabs.

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- D. Concrete Tests: Testing of composite samples of fresh concrete obtained according to ASTM C 172 shall be performed according to the following requirements:
1. Testing Frequency: Obtain one composite sample for each day's pour of each concrete mixture exceeding 5 cu. yd. (4 cu. m), but less than 25 cu. yd. (19 cu. m), plus one set for each additional 50 cu. yd. (38 cu. m) or fraction thereof.
  2. Slump: ASTM C 143/C 143M; one test at point of placement for each composite sample, but not less than one test for each day's pour of each concrete mixture. Perform additional tests when concrete consistency appears to change.
  3. Air Content: ASTM C 231, pressure method, for normal-weight concrete; one test for each composite sample, but not less than one test for each day's pour of each concrete mixture.
  4. Concrete Temperature: ASTM C 1064/C 1064M; one test hourly when air temperature is 40 deg F (4.4 deg C) and below and when 80 deg F (27 deg C) and above, and one test for each composite sample.
  5. Unit Weight: ASTM C 567, fresh unit weight of structural lightweight concrete; one test for each composite sample, but not less than one test for each day's pour of each concrete mixture.
  6. Compression Test Specimens: ASTM C 31/C 31M.
    - a. Cast and field cure three sets of standard cylinder specimens for each composite sample.
  7. Compressive-Strength Tests: ASTM C 39/C 39M; test one set of two laboratory-cured specimens at 7 days and one set of two specimens at 28 days.
    - a. Test one set of two field-cured specimens at 7 days and one set of two specimens at 28 days. If 28 day strength low hold third specimen for 56 day test.
    - b. A compressive-strength test shall be the average compressive strength from a set of two specimens obtained from same composite sample and tested at age indicated.
  8. When strength of field-cured cylinders is less than 85 percent of companion laboratory-cured cylinders, Contractor shall evaluate operations and provide corrective procedures for protecting and curing in-place concrete.
  9. Strength of each concrete mixture will be satisfactory if every average of any three consecutive compressive-strength tests equals or exceeds specified compressive strength and no compressive-strength test value falls below specified compressive strength by more than 500 psi (3.4 MPa).
  10. Test results shall be reported in writing to Architect, concrete manufacturer, and Contractor within 48 hours of testing. Reports of compressive-strength tests shall contain Project identification name and number, date of concrete placement, name of concrete testing and inspecting agency, location of concrete batch in Work, design compressive strength at 28 days, concrete mixture proportions and materials, compressive breaking strength, and type of break for both 7- and 28-day tests.
  11. Nondestructive Testing: Impact hammer, sonoscope, or other nondestructive device may be permitted by Architect but will not be used as sole basis for approval or rejection of concrete.
  12. Additional Tests: Testing and inspecting agency shall make additional tests of concrete when test results indicate that slump, air entrainment, compressive strengths, or other requirements have not been met, as directed by Architect. Testing and inspecting agency



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may conduct tests to determine adequacy of concrete by cored cylinders complying with ASTM C 42/C 42M or by other methods as directed by Architect.

13. Additional testing and inspecting, at Contractor's expense, will be performed to determine compliance of replaced or additional work with specified requirements.
  14. Correct deficiencies in the Work that test reports and inspections indicate dos not comply with the Contract Documents.
- E. Measure floor and slab flatness and levelness according to ASTM E 1155 (ASTM E 1155M) within 24 hours of finishing.

END OF SECTION 03300

SECTION 03450

ARCHITECTURAL PRECAST CONCRETE

PART 1 - GENERAL

1.01 SUMMARY

- A. This section includes precast concrete units.

1.02 PERFORMANCE REQUIREMENTS

- A. Structural Performance: Provide precast concrete units and connections capable of withstanding design loads within limits and under all existing code criteria.

1.03 SUBMITALS

- A. Product Date: For each product indicated.
- B. Design Mixes: For each concrete mix.
- C. Shop Drawings: Detail Fabrication and installation of precast concrete units. Indicate member locations, plans, elevations, dimensions, shapes, cross sections, limits of each finish and types of reinforcement, including special reinforcement.
- D. Samples: For each type of finish

1.04 QUALITY ASSURANCE:

- A. Fabricator Qualifications: A qualified fabricator who assumes responsibility for engineering precast concrete units to comply with performance requirements. This responsibility includes preparation of Shop Drawings

1.05 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.
- B. Lift and support units only at designated lifting and supporting points shown on Shop Drawings.

PART 2 - PRODUCTS

2.01 MATERIALS:

A. Steel Reinforcing:

1. Reinforcing Bars: ASTM A 615/A 615M, Grade 69, deformed.
2. Low-Alloy-Steel Reinforcing Bars: ASTM A 706/A 706M, deformed.
3. Plain-Steel Wire: ASTM A 496.
4. Deformed-Steel Wire: ASTM A496.
5. Plain-Steel Welded Wire Fabric: ASTM A 185, fabricated from as-drawn steel wire into flat sheets.
6. Deformed-Steel Welded Wire Fabric: ASTM A 497 flat sheet.
7. Supports: Manufacture's bolsters, chairs, spacers, and other devices for spacing, supporting, and fastening reinforcing bars and welded wire fabric in place according to PCI MNL 117.
8. Prestressing Strand: ASTM A 416/A 416M, Grade 250 or 270, uncoated, 7-wire, low-relaxation strand.

B. Concrete:

1. Portland Cement: ASTM C 150, Type I or Type III, of same type, brand, and source. Color samples to be submitted to Design /Builder for approval. Color to be MCTC.
2. Normal-Weight Aggregates: Except as modified by PCI MNL 117, ASTM C 33, with course aggregates complying with Class 5S.
3. Light-Weight Aggregates: ASTM C 330.
4. Coloring Admixture: ASTM C 979 synthetic mineral-oxide pigments or colored water-reducing admixtures, temperature stable, nonfading, and alkali resistant.
5. Air-Entraining Admixture: ASTM C 260.

6. Fly Ash Admixture: ASTM C 618, Class C or F.
7. Metakaloin Admixture: ASTM C 618, Class N.
8. Silica Fume Admixture: ASTM C 1240.

C. Steel Connections:

1. Carbon-Steel Shapes and Plates: ASTM A 36/A 36M.
2. Carbon-Steel Headed Studs: ASTM A 108, AISI 1018 through AISI 1020, cold finished; AWS D1.1, Type A or B, with arc shields.
3. High-Strength, Low-Alloy Structural Steel: ASTM A 572/A 572M.
4. Carbon-Steel Structural Tubing: ASTM A 500, Grade B.
5. Carbon-Steel Bolts and Studs: ASTM A 307, Grade A; carbon-steel, hex-head bolts and studs; carbon-steel nuts; and flat, unhardened steel washers.
6. Finish: For exterior steel items, steel in exterior walls, and items indicated for galvanizing, apply zinc coated by hot-dip process according to ASTM A 123/A 123M, after fabrication and ASTM A 153/A 153M as applicable.
  - a. Galvanizing Repair Paint: DOD-P-21035A or SSPC-Paint 20.
7. Shop-Primed Finish: Prepare surfaces of non-galvanized steel items, except those surfaces to be embedded in concrete, according to requirements in SSPC-SP 3 and shop-apply lead and chromate-free, rust-inhibitive primer, complying with performance requirements in FS TT-P-664, SSPC-Paint 25, according to SSPC-PA 1.

- D. Sand-Cement Grout: Portland cement, ASTM C 150, Type 1, and clean, natural sand, ASTM C 144. Mix at ratio of 1 part cement to 2 ½ parts sand, by volume, with minimum water required for placement and hydration.

2.02 CONCRETE MIXES:

- A. Light-Weight Concrete Face and Backup Mixes: Proportion mixes by either laboratory trial batch or filed test data methods according to ACI 211.1, with materials to be used on Project, to provide normal-weight concrete with the following properties:
1. Compressive Strength (28 Days): 5000 psi.

2. Maximum Water-Cementitious Materials Ratio: 0.40.

- 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.

2.03 FABRICATION:

- A. Anchorage Hardware: Fabricate with sufficient anchorage and embedment to comply with design requirements. Accurately position for attachment of loose hardware, and secure in place during pre-casting operations.
  - B. Furnish loose steel plates, clip angles, seat angles, anchors, dowels, cramps, hangers, and other hardware shapes for securing pre-cast concrete units to supporting and adjacent construction.
  - C. Cast-in reglets, slots, holes, and other accessories in precast concrete units to receive windows, cramps, dowels, reglets, waterstops, flashings, and other similar work as indicated.
  - D. Reinforcement: Comply with recommendations in CRSI's "Manual of Standard Practice" and PCI MNL 117 for fabricating, placing, and supporting reinforcement.
  - E. Reinforce precast concrete units to resist handling, transportation, and erection stresses.
  - F. Prestress tendons for precast concrete units by either pre-tensioning or post-tensioning methods. Comply with PCI MNL 117.
  - G. Mix concrete according to PCI MNL 117 and requirements in the Section. After concrete batching, no additional water may be added.
  - H. Place face mix to a minimum thickness after consolidation of the greater of 1 inch or 1.5 times the maximum aggregate size, but not less than the minimum reinforcing cover.
  - I. Place concrete in a continuous operation to prevent seams or planes of weakness from forming in precast concrete units. Comply with requirements in PCI MNL 117 for measuring, mixing, transporting and placing concrete.
1. Place backup concrete to ensure bond with face mix concrete.

- J. 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.
- K. Comply with ACI 306.1 procedures for cold-weather concrete placement.
- L. Comply with ACI 305 R recommendations for hot-weather concrete placement.
- M. Identify pickup points of precast concrete units and orientation in structure with permanent markings, complying with markings indicated on Shop Drawings. Imprint or permanently mark casting date on each precast architectural concrete unit on a surface that will not show in finished structure.
- N. 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.
- O. Discard precast concrete units that are warped, cracked, broken, spalled, stained, or otherwise defective unless repairs are approved by Design/Builder.
- P. Fabricate precast concrete units straight and true to size and shape with exposed edges and corners precise and true so each finish panel complies with PCI MNL 117 product tolerances as well as position tolerances for cast-in-items.

2.04 FINISHES:

- A. Finish to be approved by architect.
- B. Finish exposed top and bottom and side surfaces of precast concrete units to match face-surface finish.

PART 3 - EXECUTION

3.01 INSTALLATION

- A. Install precast concrete. Provide temporary supports and bracing as required to maintain position, stability, and alignment as units are being permanently connected.
  - 1. Maintain horizontal and vertical joint alignment and uniform joint width as erection progresses.

- B. Anchor precast concrete units in position by bolting, welding, grouting, or as otherwise indicated.
- C. Welding: Perform welding in compliance with AWS D1.1 and AWS D1.4, with qualified welders.
  - 1. Repair damaged steel surfaces by cleaning and applying a coat of galvanized repair paint to galvanized and re-priming damaged painted surfaces.
- D. Install pre-cast concrete units level, plumb, square, true, and in alignment without exceeding the non-cumulative erection tolerances of PCI MNL 117, Appendix 1.
- E. Repair exposed exterior surfaces of precast concrete units to match color, texture, and uniformity of surrounding precast concrete if permitted by Design/Builder.
- F. Clean exposed surfaces of precast concrete units after erection to remove weld marks, other markings, dirt and stains.

END OF SECTION

**SECTION 04200**

**UNIT MASONRY**

**1. GENERAL**

**1.1 DESCRIPTION OF WORK**

- A. Drawings and general provisions of Contract, including General Conditions and Division 1 specifications, apply to work in this section.
- B. Extent of Unit Masonry is shown on the drawings.
- C. In addition to work shown on the drawings and specified elsewhere in this Section, build in steel lintels, anchors, inserts and sleeves.

**1.2 QUALITY ASSURANCE**

- A. Standards: Comply with recommendations of Brick Institute of America (BIA), and National Concrete Masonry Assoc. (NCMA).

**1.3 SUBMITTALS**

- A. Issue submittals in accordance with Section 01 31 00, Submittals.
- B. Submit product data and installation recommendations for masonry units, cementitious products for mortar and grout, coloring pigments, throughwall flashing, and masonry accessories.
- C. Submit samples of exposed masonry units and mortar, illustrating full range of colors and textures.
- D. Build 4 x 4 sample wall on site for Architect's inspection. Sample wall to include back up wall finishes, weeps, 15# felt, brick ties.

**2 PRODUCTS**

**2.1 FACE BRICK**

- A. Face brick shall be Old Port Narrow Flashed Range.
- B. Face brick shall comply with ASTM C 216, Grade SW, Type FBS. Units shall be standard size, modular for 3/8 in. mortar joints, nominal dimensions 3-5/8 in. thick, 2-1/4 in. high, 7-5/8 in. long, and 8" x 8" x 3-5/8".



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### 2.2 CONCRETE MASONRY UNITS

- A. Except as shown on Drawings or specified otherwise, all concrete masonry units shall be as follows:
  - 1. Hollow-type complying with ASTM C 90, Type 1 (moisture-controlled), Grade N.
  - 2. Compressive strength: 2500 psi net, 1250 psi gross (average of three units). Prism strength fm=2500 psi in Pier A, fm=2000 elsewhere.
  - 3. Normal-weight, with sand and gravel aggregate complying with ASTM C 33, approximate oven-dry unit weight of 135 lbs. per cu. ft.

### 2.3 MORTAR AND GROUT

- A. Mortar shall comply with ASTM C 270, BIA Technical Notes 8 and 8A, and local Building Code.
- B. Materials shall conform to applicable ASTM specifications including the following:
  - 1. Portland Cement: ASTM 150, Types I, II, or III (do not use Types IA, IIA, or IIIA).
  - 2. Masonry Cement: ASTM C 91.
  - 3. Hydrated Lime: ASTM C 207, Type S only (do not use Type N).
  - 4. Natural or manufactured sand aggregate: ASTM C 144, gradation conforming to Table 1 in BIA Technical Note 8.
  - 5. Masonry cement shall not contain ground limestone.
  - 6. Water: clean, potable, and free of deleterious amounts of acids, alkalies or organic materials.
- C. Mortar Type
  - 1. General:
    - a. Mortar for exterior brick shall be colored, submit samples to Architect for approval.
    - b. Use 1800 psi minimum Type S mortar for reinforced masonry and where indicated.

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- c. Use 750 psi minimum Type N mortar for exterior, above-grade loadbearing and non-loadbearing walls, and for other applications where another type is not indicated.

### D. Grout

1. Grout shall conform to ASTM C 476 and to match existing.
2. Fine and coarse aggregate for grout mixes shall be defined in ASTM C 404.
  - a. Fine grout shall consist of one part portland cement, 0 to 1/10 part lime, 2-1/4 to 3 parts fine sand.
  - b. Coarse grout shall consist of the fine grout mix described in "a" above plus 1 to 2 parts coarse aggregate.
  - c. Use coarse grout (pea gravel aggregate) except where minimum horizontal core dimension is under 4 in., in which case use fine grout (sand aggregate). Ordinary concrete (maximum 1 in. aggregate) may be used where minimum core dimension exceeds 6 inches.

- E. During cold-weather construction at exterior walls, use Type III (high-early strength) cement and Type S hydrated lime. A non-calcium-chloride-based accelerator such as Dur-o-Wal, Dur-o-Guard, or Euco Accelguard 80 may be used, in quantities recommended by manufacturer for expected ambient temperature. Calcium chloride may not be used. Refer to EXECUTION portion of this Section for general provisions governing cold weather construction.

## 2.4 METAL REINFORCING, TIES, ANCHORS

- A. Acceptable manufacturers: Hohmann & Barnard, Inc., or approved equal.
- B. Brick ties at masonry veneer construction:
  1. HB-200X adjustable veneer anchors, 14 Ga., stainless steel Type 304, with Pintle Length and Legs fabricated to accommodate 2.5 inch rigid exterior insulation. Min. 2" into bed joints. **Ties to be stainless steel.**
  2. Secure anchors to sheathing with s/s wood screws as recommended by anchorage manufacturer.
  3. Maximum spacing: 24 in. o.c. vertically, 16 in. o.c. horizontally or closer spacing as required at expansion joints, corners, floors, etc., or to secure directly to studs.
  4. Material: stainless steel.

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5. Masonry Joint Reinforcement: ASTM A 951/A 951M. Either ladder or truss type with single pair of side rods.

6. Uncoated Steel Reinforcing Bars: ASTM A 615/A 615M or ASTM A 996/A 996M, Grade 60

### 2.5 THROUGHWALL FLASHING

A. Through-wall flashing: Thru wall flashing at base and all window and door heads to be equal to "EPRA"- max EPDM. Flashing to be extended sufficiently beyond jambs and form end dams. Thru wall flashing with H & B # DP stainless steel drip plate as manufactured by Hohmann & Barnard Inc. "Henry Thru Wall", blue skin is also an acceptable product.

B. Through-wall flashing sealant: Shall be Sandell Trowel Mastic, as manufactured by Sandell Manufacturing Co., Inc.

### 2.6 AIR BARRIER

~~A. Typar Metro Wrap Air Moisture Barrier (located behind exterior rigid insulation). Refer to Specification Section 07-21-16.~~

### 2.7 MASONRY ACCESSORIES

A. Weepholes: medium-density polyethylene, 3/8 in. diameter, full depth of outer wythe.

B. Chemical cleaning agents for newly-installed masonry: ProSoco Sure-Klean liquid masonry cleaners or equal by Diedrich, as recommended by manufacturer for particular condition. Recommended cleaners include Sure-Klean No. 600 Detergent, No. 101 Lime Solvent, and Vana Trol.

C. Apply water proofing – Karnac 920 A.F. or Henry 785 Asphalt Emulsion trowel grade, on all block face bearing brick veneer.

## 3. EXECUTION

### 3.1 MASONRY WORK IN GENERAL

A. Erect all masonry work in compliance with the line and level tolerances specified herein. Correct, or replace, as directed by the Architect, non-conforming masonry work at no additional cost to the Contract.

B. Lay no face brick or concrete masonry unit having chipped edges or face defects where such unit or piece would be exposed to view. Remove any such unit or piece, if installed, replace with new matching material, and bear all costs therefore.

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- C. Examine all Drawings as to requirements for the accommodation of work of other trades. Provide all required recesses, chases, slots, cutouts, and set loose lintels. Place anchors, bolts, sleeves and other items occurring in the masonry work. Take every precaution to minimize future cutting and patching. Closely coordinate the location and placement of such items.
- D. Protect all masonry from rain prior to, and during the installation thereof. If the temperature is in excess of 80 degrees F. at time of installation, lightly moisten contact surfaces or masonry units by brushing with water.
- E. Lay all masonry in full mortar beds, and completely butter all concealed from view vertical edges with mortar. Completely fill cells of masonry units with mortar where vertical reinforcement is to be installed therein and in other locations specified or indicated on the Drawings.
- F. Provide complete protection against breakage and weather damage to all masonry work, including substantial wood boxing around door jambs, over the tops of walls and wherever necessary to protect work at all stages of completion. Protect masonry when not roofed over, at all times when masons are not working on the walls. Apply non-staining tarpaulins or waterproof paper, properly weighted, or nailed, to assure their remaining in place to protect masonry from all possible hazards.
- G. Fit masonry into bucks and frames so as not to distort alignment of such items, and fill backs of such items with mortar, except where joints are indicated to receive caulking and sealant and have no compressible filler therein, in which case rake joints to a uniform depth of  $\frac{3}{4}$  inch for proper installation of caulking and sealant material.
- H. Use only power saw, equipped with carborundum blade, for cutting exposed masonry, as needed to assure straight, evenly-cut edges.
- I. Lay out coursing before setting to minimize cutting closures or jumping bond. Do not spread any more mortar than can be covered before surface of mortar has begun to dry. Do not endanger bond or mortar by moving masonry when once laid. If necessary to re-adjust any items, remove entirely, clean-off mortar, and reset with fresh mortar.
- J. Except for cleaning down and pointing, finish all new masonry as the walls and partitions are carried up.
- K. Point and fill all holes and cracks in mortar joints with additional fresh mortar; do not merely spread adjacent mortar over defect or use dead mortar droppings. Do all pointing while mortar is still soft and plastic. If hardened, chisel defect out and refill solidly with fresh additional mortar, and tool as specified.

### 3.2 JOB CONDITIONS

- A. Store cement, lime and other cementitious materials under cover in a dry place.

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- B. Keep steel reinforcing, ties and anchors free from oil, dirt, rust, and other materials which would destroy bond.
- C. Store masonry above ground on level platforms which allow air circulation under stacked units. Masonry units shall be dry and free from soil and ice before being laid in wall.
- D. Keep installed walls dry and clean at all times. Immediately remove grout or mortar from face of masonry to be left exposed or painted. Protect previously installed elements such as louvers, doors, frames, and windows from mortar droppings and construction damage, using masking elements, dropcloths, etc.
- E. Cover exposed walls at end of working day with well-secured canvas tarpaulins. Protect base of exterior walls from splashing mud and mortar by spreading sand, raw, and sawdust or plastic sheeting 3 to 4 ft. horizontally and up face of wall. Turn scaffold boards near wall on edge at end of day to prevent splashing mortar or dirt.
- F. Securely brace partially completed walls against wind damage. Walls shall have been completed 24 hours minimum before application of distributed loads, 72 hours before concentrated loads.
- G. Comply with cold-weather construction specifications in NCMA-TEK 16 and BIA Technical Note 1A:
  - 1. Maintain masonry above 32 degrees F. for 24 hours minimum using insulated blankets or heated enclosures. Construct windbreaks at wind velocities over 15 mph. Maintain mortar on board at 40 degrees F. minimum, heating mixing water and sand as required.
  - 2. Sprinkle units with high rates of absorption with heated water. Refer to mortar paragraph under PRODUCTS in this Section for provisions governing cold-weather additives to mortar. If standard instead of Type III high-early strength cement must be used, maintain installed masonry above freezing for 48 instead of 24 hours.
  - 3. Do no masonry work at temperatures below 38 degrees F and falling or 35 degrees F and rising, until General Contractor has contacted Architect.

### 3.3 INSTALLATION

- A. Verify that substrate is dry and free from frost, dirt, laitance, loose sand and other material which would prevent satisfactory bond. Lay first course in full mortar bed including face shells and webs of concrete masonry units. Keep cells to be grouted free from mortar.
- B. Dampen masonry units as required to prevent excess suction of mortar. Lay concrete masonry units to form continuous unobstructed vertical spaces within wall. Provide full

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mortar coverage on horizontal and vertical face shells. Also bed webs adjacent to reinforced cores to prevent grout leakage, except omit web bedding at fully grouted walls to permit grout to flow laterally. Lay face brick with full vertical and bed joints, except as specified below to provide weepholes. Cut exposed masonry units, where necessary, with a power saw. Avoid the use (by proper layout) of less-than-half-size units.

- C. Install masonry units in the bond pattern indicated, or if none is indicated, in running bond.
- D. Step back unfinished work -- toothing is not permitted. Do not adjust installed units -- where necessary, completely remove and reinstall using fresh mortar.
- D. Maximum variation of installed walls from plumb, level, or plan grid shall not exceed 1/4 in. in 10 ft. Wall thickness shall not vary more than 1/4 in. plus or minus from dimension shown on drawings.
- E. Placing Reinforcement: Comply with requirements in ACI 530.1/ASCE 6/TMS 602.
- F. Comply with requirements in ACI 530.1/ASCE 6/TMS 602 for cleanouts and for grout placement, including minimum grout space and maximum pour height.
- F. Mortar:
  - 1. Measure materials in calibrated containers, or by similar easily-controlled and maintained method. Do not use shovel measurement.
  - 2. Mix materials in a mechanical mixer at least three minutes with minimum amount of water necessary to produce a workable consistency. Retemper stiffened mortar as required to restore evaporated water, but do not place mortar any later than 2-1/2 hours after mixing.
  - 3. Exposed-to-view joints shall be approximately 3/8 in. wide, to meet coursing shown, tooled when thumbprint hard with a round bar to produce a dense, slightly concave surface well-bonded to masonry edges.
  - 4. After tooling, cut off mortar tailings with a trowel and brush off excess. Concealed joints, including those on cavity side of masonry veneer, and joints in masonry to be plastered or stuccoed shall be struck off flush, with no protrusions.
  - 5. Mortar not tight at time of tooling shall be raked out, pointed with fresh mortar, and retooled. Where sealant is shown, rake out joint 3/4 in., ready for backer rod and sealant specified in Division 7 sealants Section.
- G. Through-wall flashing:

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1. Install flashing to the profiles shown on the drawings.
  2. Masonry and concrete surfaces receiving through wall flashings shall be thoroughly dry, free from loose material, and reasonably smooth. There shall be no slopes that will form pockets or prevent free drainage of water to exterior surfaces of wall.
  3. Set flashing in sealant. Hold sealant back 1/4 inch from face of lintel. Hold flashing 1/2 inch back from face of lintel.
  4. At wall openings, extend flashing 6 in. beyond each side of opening and turn up to form pan. Fold all corners, do not cut.
  5. Lap joints between lengths of flashing 6 in. minimum and seal with mastic. Seal penetrations through flashing with mastic or overlapping piece of flashing.
- H. Provide weepholes at 24 inches on center maximum spacing through outer face of masonry at all through-wall flashing.
- I. At masonry veneer construction over gypsum sheathing, provide rubber washers or bituminous dampproofing compound at all penetrations made in sheathing board or paper as part of work under this Section, including screw heads and veneer-tie anchorage.
- J. Provide openings and chases as required for structural members, ductwork, large pipes, etc. Cut exposed masonry with carborundum saw to ensure straight even edges. Neatly block around and patch penetrations. Provide compressible filler around edges of openings to accommodate vibration and structural deflection. Ensure that joint reinforcement remains uncut or is well-lapped.
- K. Provide control and expansion joints at locations shown, and keep clean of mortar droppings. Install Joint Sealers in accordance with Section 07 92 00.
- L. Build other work into the masonry work as shown, fitting masonry units around other work, and grouting to secure anchorage.

### 3.4 ALLOWABLE TOLERANCES FOR MASONRY WORK

- A. Maximum variation from true surface level for exposed to view walls and partitions:
1. Unit-to-unit tolerance: 1/8 inch.
  2. Surface, overall tolerance: 1/4 inch in 10 feet in any direction when tested with ten foot long straightedge. Where both faces of wall or partition will be exposed to view, request

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and obtain decision from the Architect as to which face will be required to conform to the specified surface level tolerance.

- B. Maximum variation from true vertical plumb lines:
  - 1. In lines of walls and arises:
    - a.  $\frac{1}{4}$  inch in 10 feet.
    - b.  $\frac{3}{8}$  inch in any story, or up to 20 feet maximum.
    - c.  $\frac{1}{2}$  inch in 40 feet maximum.
  - 2. For external corner lines, control joints, and other conspicuous lines:
    - a.  $\frac{1}{4}$  inch in any story, or up to 20 feet maximum.
- C. Maximum variation from horizontal level or grades for exposed sills, lintel blocks, and other conspicuous lines:
  - 1.  $\frac{1}{4}$  inch in any bay, or up to 20 feet maximum.
  - 2.  $\frac{1}{2}$  inch in 40 feet maximum.
- D. Maximum variation of linear building line from an established position in plan and related portions of walls and partitions:
  - 1.  $\frac{1}{2}$  inch in any bay or up to 20 feet.
  - 2.  $\frac{3}{4}$  inch in 40 feet maximum.

### 3.5 WALL AND PARTITION CONSTRUCTION

- A. General:
  - 1. Build the masonry walls and partitions in the various combinations and thickness as indicated on the Drawings and as herein specified.
  - 2. Build in anchorage items and loose lintels as the work progresses.
  - 3. Lay first course of masonry on a smooth bed or mortar, after supporting concrete has been cleaned. Fill cells of first course concrete masonry units with mortar in all cases. Completely fill cells of concrete masonry units wherever vertical reinforcing rods are installed therein.
  - 4. For exterior masonry cavity walls, install cavity insulation, through wall membrane flashings, weep wicks, and peastone, as specified herein.



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5. Fill pressed metal frames occurring in masonry with mortar, as the masonry is erected.

### 3.6 GROUT

- A. Lay masonry units with core cells vertically aligned and cavities clear of mortar and unobstructed.
- B. Permit mortar to cure three (3) days before placing grout.
- C. Consolidation: Consolidate grout at the time of placement per ACI 530.
- D. ACI 530 Building Code requirements for Masonry Structures and ACI 530 Specifications for Masonry Structures are made part of this specification as are all pertinent sections of the ACI Building Code.

### 3.6 CLEANING MASONRY

- A. Masonry cleaning procedures shall follow recommendations of NCMA-TEK 45 and BIA Technical Note 20 (revised).
- B. Dry brush masonry work at end of each day's work.
- C. After new mortar has cured 14 days minimum, remove large mortar particles with non-metallic scrapers, chisels, or wooden paddles. Wash off dirt and other foreign materials with clean water and light concentration of soap or detergent.
- D. For mortar smears, construction dirt, stains, efflorescence, etc., not removable by above methods, use proprietary cleaners specified under PRODUCTS. Muriatic acid may not be used. Adhere strictly to manufacturer's recommendations.
- E. Apply and scrub cleaning solutions with non-metallic fibrous brushes. Thoroughly rinse cleaned area before cleaning solution can dry, using water hosed under moderate pressure.

**END OF SECTION**

SECTION 05120

STRUCTURAL STEEL FRAMING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:

1. Structural steel.
2. Grout.

B. Related Sections:

1. Division 01 Section "Quality Requirements" for independent testing agency procedures and administrative requirements.
2. Division 05 Section "Architecturally Exposed Structural Steel Framing" for additional requirements for architecturally exposed structural steel.
3. Division 05 Section "Steel Decking" for field installation of shear connectors through deck.
4. Division 05 Section "Metal Fabrications" for miscellaneous steel fabrications not defined as structural steel.
5. Division 05 Section "Metal Stairs."
6. Division 09 painting Sections for surface-preparation and priming requirements.

1.3 DEFINITIONS

- A. Structural Steel: Elements of structural-steel frame, as classified by AISC 303, "Code of Standard Practice for Steel Buildings and Bridges."

1.4 PERFORMANCE REQUIREMENTS

- A. Connections: Provide details of simple shear connections required by the Contract Documents to be selected or completed by structural-steel fabricator to withstand loads indicated and comply with other information and restrictions indicated.

1. Select and complete connections using schematic details indicated and AISC 360.
2. Use LRFD as indicated on the drawings; data are given at factored-load level.

- B. Moment Connections: Type FR, fully restrained.

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- C. Construction: Combined system of moment frame, braced frame, and shear walls.

### 1.5 SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Shop Drawings: Show fabrication of structural-steel components.
  - 1. Include details of cuts, connections, splices, camber, holes, and other pertinent data.
  - 2. Include embedment drawings.
  - 3. Indicate welds by standard AWS symbols, distinguishing between shop and field welds, and show size, length, and type of each weld. Show backing bars that are to be removed and supplemental fillet welds where backing bars are to remain.
  - 4. Indicate type, size, and length of bolts, distinguishing between shop and field bolts. Identify pretensioned and slip-critical high-strength bolted connections.
  - 5. Identify members and connections of the seismic-load-resisting system.
  - 6. For structural-steel connections indicated to comply with design loads, include structural design data signed and sealed by the qualified professional engineer responsible for their preparation.
- C. Welding certificates.
- D. Paint Compatibility Certificates: From manufacturers of topcoats applied over shop primers, certifying that shop primers are compatible with topcoats.
- E. Mill test reports for structural steel, including chemical and physical properties.

### 1.6 QUALITY ASSURANCE

- A. Fabricator Qualifications: A qualified fabricator that participates in the AISC Quality Certification Program and is designated an AISC-Certified Plant, Category STD.
- B. Installer Qualifications: A qualified installer who participates in the AISC Quality Certification Program and is designated an AISC-Certified Erector, Category CSE.
- C. Welding Qualifications: Qualify procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code - Steel."
  - 1. Welders and welding operators performing work on bottom-flange, demand-critical welds shall pass the supplemental welder qualification testing, as required by AWS D1.8. FCAW-S and FCAW-G shall be considered separate processes for welding personnel qualification.
- D. Comply with applicable provisions of the following specifications and documents:
  - 1. AISC 303.
  - 2. AISC 341 and AISC 341s1.
  - 3. AISC 360.
  - 4. RCSC's "Specification for Structural Joints Using ASTM A 325 or A 490 Bolts."
- E. Preinstallation Conference: Conduct conference at Project site.

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### 1.7 DELIVERY, STORAGE, AND HANDLING

- A. Store materials to permit easy access for inspection and identification. Keep steel members off ground and spaced by using pallets, dunnage, or other supports and spacers. Protect steel members and packaged materials from corrosion and deterioration.
  - 1. Do not store materials on structure in a manner that might cause distortion, damage, or overload to members or supporting structures. Repair or replace damaged materials or structures as directed.
- B. Store fasteners in a protected place in sealed containers with manufacturer's labels intact.
  - 1. Fasteners may be repackaged provided Owner's testing and inspecting agency observes repackaging and seals containers.
  - 2. Clean and relubricate bolts and nuts that become dry or rusty before use.
  - 3. Comply with manufacturers' written recommendations for cleaning and lubricating ASTM F 1852 fasteners and for retesting fasteners after lubrication.

### 1.8 COORDINATION

- A. Coordinate selection of shop primers with topcoats to be applied over them. Comply with paint and coating manufacturers' recommendations to ensure that shop primers and topcoats are compatible with one another.
- B. Coordinate installation of anchorage items to be embedded in or attached to other construction without delaying the Work. Provide setting diagrams, sheet metal templates, instructions, and directions for installation.

## PART 2 - PRODUCTS

### 2.1 STRUCTURAL-STEEL MATERIALS

- A. W-Shapes: ASTM A 992/A 992M, Grade 50 (345).
- B. Channel and Angle-Shapes: ASTM A 36/A 36M.
- C. Plate and Bar: ASTM A 36/A 36M.
- D. Cold-Formed Hollow Structural Sections: ASTM A 500, Grade B or C, structural tubing.
- E. Steel Pipe: ASTM A 53/A 53M, Type E or S, Grade B.
  - 1. Weight Class: Standard.
  - 2. Finish: Black.
- F. Welding Electrodes: Comply with AWS requirements.

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### 2.2 BOLTS, CONNECTORS, AND ANCHORS

- A. High-Strength Bolts, Nuts, and Washers: ASTM A 325 (ASTM A 325M), Type 1, heavy-hex steel structural bolts; ASTM A 563, Grade C, (ASTM A 563M, Class 8S) heavy-hex carbon-steel nuts; and ASTM F 436 (ASTM F 436M), Type 1, hardened carbon-steel washers; all with plain finish.
  - 1. Direct-Tension Indicators: ASTM F 959, Type 325 (ASTM F 959M, Type 8.8), compressible-washer type with plain finish.
- B. High-Strength Bolts, Nuts, and Washers: ASTM A 490 (ASTM A 490M), Type 1, heavy-hex steel structural bolts or tension-control, bolt-nut-washer assemblies with splined ends; ASTM A 563, Grade DH, (ASTM A 563M, Class 10S) heavy-hex carbon-steel nuts; and ASTM F 436 (ASTM F 436M), Type 1, hardened carbon-steel washers with plain finish.
  - 1. Direct-Tension Indicators: ASTM F 959, Type 490 (ASTM F 959M, Type 10.9), compressible-washer type with plain finish.
- C. Shear Connectors: ASTM A 108, Grades 1015 through 1020, headed-stud type, cold-finished carbon steel; AWS D1.1/D1.1M, Type B.
- D. Unheaded Anchor Rods: ASTM F 1554, Grade 36 and ASTM A 449.
  - 1. Configuration: Straight and Hooked.
  - 2. Nuts: ASTM A 563 (ASTM A 563M) heavy-hex carbon steel.
  - 3. Plate Washers: ASTM A 36/A 36M carbon steel.
  - 4. Washers: ASTM F 436 (ASTM F 436M), Type 1, hardened carbon steel.
  - 5. Finish: Plain.
- E. Threaded Rods: ASTM A 36/A 36M or ASTM A 449.
  - 1. Nuts: ASTM A 563 (ASTM A 563M) heavy-hex carbon steel.
  - 2. Washers: ASTM F 436 (ASTM F 436M), Type 1, hardened carbon steel.
  - 3. Finish: Plain.

### 2.3 PRIMER

- A. Primer: Fabricator's standard lead- and chromate-free, nonasphaltic, rust-inhibiting primer complying with MPI#79 and compatible with topcoat.

### 2.4 GROUT

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

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### 2.5 FABRICATION

- A. Structural Steel: Fabricate and assemble in shop to greatest extent possible. Fabricate according to AISC's "Code of Standard Practice for Steel Buildings and Bridges" and AISC 360.
  - 1. Camber structural-steel members where indicated.
  - 2. Fabricate beams with rolling camber up.
  - 3. Identify high-strength structural steel according to ASTM A 6/A 6M and maintain markings until structural steel has been erected.
  - 4. Mark and match-mark materials for field assembly.
  - 5. Complete structural-steel assemblies, including welding of units, before starting shop-priming operations.
- B. Thermal Cutting: Perform thermal cutting by machine to greatest extent possible.
  - 1. Plane thermally cut edges to be welded to comply with requirements in AWS D1.1/D1.1M.
- C. Bolt Holes: Cut, drill, or punch standard bolt holes perpendicular to metal surfaces.
- D. Finishing: Accurately finish ends of columns and other members transmitting bearing loads.
- E. Cleaning: Clean and prepare steel surfaces that are to remain unpainted according to SSPC-SP 1, "Solvent Cleaning."
- F. Holes: Provide holes required for securing other work to structural steel and for other work to pass through steel framing members.
  - 1. Cut, drill, or punch holes perpendicular to steel surfaces. Do not thermally cut bolt holes or enlarge holes by burning.
  - 2. Baseplate Holes: Cut, drill, mechanically thermal cut, or punch holes perpendicular to steel surfaces.
  - 3. Weld threaded nuts to framing and other specialty items indicated to receive other work.

### 2.6 SHOP CONNECTIONS

- A. High-Strength Bolts: Shop install high-strength bolts according to RCSC's "Specification for Structural Joints Using ASTM A 325 or A 490 Bolts" for type of bolt and type of joint specified.
  - 1. Joint Type: Snug tightened.
- B. Weld Connections: Comply with AWS D1.1/D1.1M and AWS D1.8/D1.8M for tolerances, appearances, welding procedure specifications, weld quality, and methods used in correcting welding work.
  - 1. Assemble and weld built-up sections by methods that will maintain true alignment of axes without exceeding tolerances in AISC 303 for mill material.

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### 2.7 SHOP PRIMING

- A. Shop prime steel surfaces except the following:
  - 1. Surfaces embedded in concrete or mortar. Extend priming of partially embedded members to a depth of 2 inches (50 mm).
  - 2. Surfaces to be field welded.
  - 3. Surfaces to be high-strength bolted with slip-critical connections.
  - 4. Surfaces to receive sprayed fire-resistive materials (applied fireproofing).
- B. Surface Preparation: Clean surfaces to be painted. Remove loose rust and mill scale and spatter, slag, or flux deposits. Prepare surfaces according to the following specifications and standards:
  - 1. SSPC-SP 2, "Hand Tool Cleaning."
- C. Priming: Immediately after surface preparation, apply primer according to manufacturer's written instructions and at rate recommended by SSPC to provide a minimum dry film thickness of 1.5 mils (0.038 mm). Use priming methods that result in full coverage of joints, corners, edges, and exposed surfaces.

## PART 3 - EXECUTION

### 3.1 EXAMINATION

- A. Verify, with steel Erector present, elevations of concrete- and masonry-bearing surfaces and locations of anchor rods, bearing plates, and other embedments for compliance with requirements.
  - 1. Prepare a certified survey of bearing surfaces, anchor rods, bearing plates, and other embedments showing dimensions, locations, angles, and elevations.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

### 3.2 PREPARATION

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

### 3.3 ERECTION

- A. Set structural steel accurately in locations and to elevations indicated and according to AISC 303 and AISC 360.

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

### 3.4 FIELD CONNECTIONS

- A. High-Strength Bolts: Install high-strength bolts according to RCSC's "Specification for Structural Joints Using ASTM A 325 or A 490 Bolts" for type of bolt and type of joint specified.
  - 1. Joint Type: Snug tightened.
- B. Weld Connections: Comply with AWS D1.1/D1.1M and AWS D1.8/D1.8M for tolerances, appearances, welding procedure specifications, weld quality, and methods used in correcting welding work.
  - 1. Comply with AISC 303 and AISC 360 for bearing, alignment, adequacy of temporary connections, and removal of paint on surfaces adjacent to field welds.
  - 2. Remove backing bars or runoff tabs where indicated, back gouge, and grind steel smooth.



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3. Assemble and weld built-up sections by methods that will maintain true alignment of axes without exceeding tolerances in AISC's "Code of Standard Practice for Steel Buildings and Bridges" for mill material.

### 3.5 FIELD QUALITY CONTROL

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

### 3.6 REPAIRS AND PROTECTION

- A. Touchup Painting: Immediately after erection, clean exposed areas where primer is damaged or missing and paint with the same material as used for shop painting to comply with SSPC-PA 1 for touching up shop-painted surfaces.
  1. Clean and prepare surfaces by SSPC-SP 2 hand-tool cleaning or SSPC-SP 3 power-tool cleaning.
- B. Touchup Painting: Cleaning and touchup painting are specified in Division 09 painting Sections.

END OF SECTION 051200

SECTION 05200

METAL JOISTS

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. K-series steel joists.
  - 2. KCS-type K-series steel joists.
  - 3. Joist accessories.
- B. Related Sections include the following:
  - 1. Division 5 Section "Structural Steel"

1.3 DEFINITIONS

- A. SJI "Specifications": Steel Joist Institute's "Standard Specifications, Load Tables and Weight Tables for Steel Joists and Joist Girders."
- B. Special Joists: Steel joists requiring modification by manufacturer to support nonuniform, unequal, or special loading conditions that invalidate load tables in SJI's "Specifications."

1.4 PERFORMANCE REQUIREMENTS

- A. Structural Performance: Provide special joists and connections capable of withstanding design loads indicated.
- B. Design special joists to withstand design loads with live load deflections no greater than the following:
  - 1. Roof Joists: Vertical deflection of 1/360 of the span.

1.5 SUBMITTALS

- A. Product Data: For each type of joist, accessory, and product indicated.

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- B. Shop Drawings: Show layout, designation, number, type, location, and spacings of joists. Include joining and anchorage details, bracing, bridging, joist accessories; splice and connection locations and details; and attachments to other construction.
  - 1. Indicate locations and details of bearing plates to be embedded in other construction.
  - 2. Comprehensive engineering analysis of special joists signed and sealed by the qualified professional engineer responsible for its preparation.
- C. Welding certificates.
- D. Manufacturer Certificates: Signed by manufacturers certifying that joists comply with requirements.

### 1.6 QUALITY ASSURANCE

- A. Manufacturer Qualifications: A manufacturer certified by SJI to manufacture joists complying with applicable standard specifications and load tables of SJI "Specifications."
  - 1. Manufacturer's responsibilities include providing professional engineering services for designing special joists to comply with performance requirements.
- B. SJI Specifications: Comply with standard specifications in SJI's "Specifications" that are applicable to types of joists indicated.
- C. Welding: Qualify procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code - Steel."

### 1.7 DELIVERY, STORAGE, AND HANDLING

- A. Deliver, store, and handle joists as recommended in SJI's "Specifications."
- B. Protect joists from corrosion, deformation, and other damage during delivery, storage, and handling.

## PART 2 - PRODUCTS

### 2.1 MATERIALS

- A. Steel: Comply with SJI's "Specifications" for web and steel-angle chord members.
- B. Steel Bearing Plates: ASTM A 36/A 36M.
- C. Carbon-Steel Bolts and Threaded Fasteners: ASTM A 307, Grade A , carbon-steel, hex-head bolts and threaded fasteners; carbon-steel nuts; and flat, unhardened steel washers.
  - 1. Finish: Plain, uncoated.

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- D. High-Strength Bolts, Nuts, and Washers: ASTM A 325 (ASTM A 325M), Type 1, heavy hex steel structural bolts; ASTM A 563 (ASTM A 563M) heavy hex carbon-steel nuts; and ASTM F 436 (ASTM F 436M) hardened carbon-steel washers.
  - 1. Finish: Plain.
- E. Welding Electrodes: Comply with AWS standards.

### 2.2 PRIMERS

- A. Primer: SSPC-Paint 15, or manufacturer's standard shop primer complying with performance requirements in SSPC-Paint 15.
- B. Primer: Provide shop primer that complies with Division 9 painting Sections.

### 2.3 K-SERIES STEEL JOISTS

- A. Manufacture steel joists of type indicated according to "Standard Specifications for Open Web Steel Joists, K-Series" in SJI's "Specifications," with steel-angle top- and bottom-chord members, underslung ends, and parallel top chord.
  - 1. Joist Type: K-series steel joists and KCS-type K-series steel joists.
- B. Steel Joist Substitutes: Manufacture according to "Standard Specifications for Open Web Steel Joists, K-Series" in SJI's "Specifications," with steel-angle or -channel members.
- C. Comply with AWS requirements and procedures for shop welding, appearance, quality of welds, and methods used in correcting welding work.
- D. Provide holes in chord members for connecting and securing other construction to joists.
- E. Top-Chord Extensions: Extend top chords of joists with SJI's Type S top-chord extensions where indicated, complying with SJI's "Specifications."
- F. Extended Ends: Extend bearing ends of joists with SJI's Type R extended ends where indicated, complying with SJI's "Specifications."
- G. Do not camber joists.
- H. Camber joists according to SJI's "Specifications."
- I. Equip bearing ends of joists with manufacturer's standard beveled ends or sloped shoes if joist slope exceeds 1/4 inch per 12 inches (1:48).

### 2.4 JOIST ACCESSORIES

- A. Bridging: Provide bridging anchors and number of rows of horizontal or diagonal bridging of material, size, and type required by SJI's "Specifications" for type of joist, chord size, spacing, and span. Furnish additional erection bridging if required for stability.

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- B. Bridging: Schematically indicated. Detail and fabricate according to SJI's "Specifications." Furnish additional erection bridging if required for stability.
- C. Bridging: Fabricate as indicated and according to SJI's "Specifications." Furnish additional erection bridging if required for stability.
- D. Supply ceiling extensions, either extended bottom-chord elements or a separate extension unit of enough strength to support ceiling construction. Extend ends to within 1/2 inch (13 mm) of finished wall surface, unless otherwise indicated.
- E. Supply miscellaneous accessories, including splice plates and bolts required by joist manufacturer to complete joist installation.

### 2.5 CLEANING AND SHOP PAINTING

- A. Clean and remove loose scale, heavy rust, and other foreign materials from fabricated joists and accessories by hand-tool cleaning, SSPC-SP 2.
- B. Do not prime paint joists and accessories to receive sprayed fire-resistive materials.
- C. Apply 1 coat of shop primer to joists and joist accessories to be primed to provide a continuous, dry paint film not less than 1 mil (0.025 mm) thick.
- D. Shop priming of joists and joist accessories is specified in Division 9 painting Sections.

## PART 3 - EXECUTION

### 3.1 EXAMINATION

- A. Examine supporting substrates, embedded bearing plates, and abutting structural framing for compliance with requirements for installation tolerances and other conditions affecting performance.
  - 1. Proceed with installation only after unsatisfactory conditions have been corrected.

### 3.2 INSTALLATION

- A. Do not install joists until supporting construction is in place and secured.
- B. Install joists and accessories plumb, square, and true to line; securely fasten to supporting construction according to SJI's "Specifications," joist manufacturer's written recommendations, and requirements in this Section.
  - 1. Before installation, splice joists delivered to Project site in more than one piece.
  - 2. Space, adjust, and align joists accurately in location before permanently fastening.
  - 3. Install temporary bracing and erection bridging, connections, and anchors to ensure that joists are stabilized during construction.

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4. Delay rigidly connecting bottom-chord extensions to columns or supports until dead loads have been applied.
- C. Field weld joists to supporting steel framework. Coordinate welding sequence and procedure with placement of joists. Comply with AWS requirements and procedures for welding, appearance and quality of welds, and methods used in correcting welding work.
- D. Bolt joists to supporting steel framework using carbon-steel bolts.
- E. Bolt joists to supporting steel framework using high-strength structural bolts. Comply with RCSC's "Specification for Structural Joints Using ASTM A 325 or ASTM A 490 Bolts" for high-strength structural bolt installation and tightening requirements.
- F. Install and connect bridging concurrently with joist erection, before construction loads are applied. Anchor ends of bridging lines at top and bottom chords if terminating at walls or beams.

### 3.3 FIELD QUALITY CONTROL

- A. Testing Agency: Owner will engage a qualified independent testing and inspecting agency to inspect field welds and bolted connections and to perform field tests and inspections and prepare test and inspection reports.
- B. Field welds will be visually inspected according to AWS D1.1/D1.1M.
- C. Bolted connections will be visually inspected.
- D. High-strength, field-bolted connections will be tested and verified according to procedures in RCSC's "Specification for Structural Joints Using ASTM A 325 or ASTM A 490 Bolts."
- E. Correct deficiencies in Work that test and inspection reports have indicated are not in compliance with specified requirements.
- F. Additional testing will be performed to determine compliance of corrected Work with specified requirements.

### 3.4 REPAIRS AND PROTECTION

- A. Repair damaged galvanized coatings on galvanized items with galvanized repair paint according to ASTM A 780 and manufacturer's written instructions.
- B. Touchup Painting: After installation, promptly clean, prepare, and prime or reprime field connections, rust spots, and abraded surfaces of prime-painted joists, abutting structural steel, and accessories.
  1. Clean and prepare surfaces by hand-tool cleaning, SSPC-SP 2, or power-tool cleaning, SSPC-SP 3.
  2. Apply a compatible primer of same type as shop primer used on adjacent surfaces.
- C. Touchup Painting: Cleaning and touchup painting are specified in Division 9 painting Sections.

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- D. Provide final protection and maintain conditions, in a manner acceptable to manufacturer and Installer, that ensure that joists and accessories are without damage or deterioration at time of Substantial Completion.

END OF SECTION 05210

SECTION 05310

STEEL DECKING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:

- 1. Roof deck.
- 2. Composite floor deck.

B. Related Requirements:

- 1. Section 033000 "Cast-in-Place Concrete" for normal-weight and lightweight structural concrete fill over steel deck.
- 2. Section 051200 "Structural Steel Framing" for shop- and field-welded shear connectors.
- 3. Division 09 painting sections for repair painting of primed deck.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of deck, accessory, and product indicated.

B. Shop Drawings:

- 1. Include layout and types of deck panels, anchorage details, reinforcing channels, pans, cut deck openings, special jointing, accessories, and attachments to other construction.

1.4 INFORMATIONAL SUBMITTALS

- A. Welding certificates.

- B. Product Certificates: For each type of steel deck.

- C. Product Test Reports: Based on evaluation of comprehensive tests performed by a qualified testing agency, indicating that each of the following complies with requirements:

- 1. Power-actuated mechanical fasteners.



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- D. Evaluation Reports: For steel deck.
- E. Field quality-control reports.

### 1.5 QUALITY ASSURANCE

- A. Testing Agency Qualifications: Qualified according to ASTM E 329 for testing indicated.
- B. Welding Qualifications: Qualify procedures and personnel according to AWS D1.3, "Structural Welding Code - Sheet Steel."
- C. FM Global Listing: Provide steel roof deck evaluated by FM Global and listed in its "Approval Guide, Building Materials" for Class 1 fire rating and Class 1-90 windstorm ratings.

### 1.6 DELIVERY, STORAGE, AND HANDLING

- A. Protect steel deck from corrosion, deformation, and other damage during delivery, storage, and handling.
- B. Stack steel deck on platforms or pallets and slope to provide drainage. Protect with a waterproof covering and ventilate to avoid condensation.
  - 1. Protect and ventilate acoustical cellular roof deck with factory-installed insulation to maintain insulation free of moisture.

## PART 2 - PRODUCTS

### 2.1 PERFORMANCE REQUIREMENTS

- A. AISI Specifications: Comply with calculated structural characteristics of steel deck according to AISI's "North American Specification for the Design of Cold-Formed Steel Structural Members."

### 2.2 ROOF DECK

- A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
  - 1. ASC Profiles, Inc.; a Blue Scope Steel company.
  - 2. Canam United States; Canam Group Inc.
  - 3. CMC Joist & Deck.
  - 4. Consolidated Systems, Inc.; Metal Dek Group.
  - 5. Cordeck.
  - 6. DACS, Inc.
  - 7. Epic Metals Corporation.
  - 8. Marlyn Steel Decks, Inc.

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9. New Millennium Building Systems, LLC.
10. Nucor Corp.; Vulcraft Group.
11. Roof Deck, Inc.
12. Valley Joist; Subsidiary of EBSCO Industries, Inc.
13. Verco Manufacturing Co.
14. Wheeling Corrugating Company; Div. of Wheeling-Pittsburgh Steel Corporation.

B. Roof Deck: Fabricate panels, without top-flange stiffening grooves, to comply with "SDI Specifications and Commentary for Steel Roof Deck," in SDI Publication No. 31, and with the following:

1. Prime-Painted Steel Sheet: ASTM A 1008/A 1008M, Structural Steel (SS), Grade 33 (230) minimum, shop primed with manufacturer's standard baked-on, rust-inhibitive primer.
  - a. Color: Manufacturer's standard Gray.
2. Deck Profile: As indicated.
3. Profile Depth: As indicated.
4. Design Uncoated-Steel Thickness: As indicated.
5. Span Condition: Triple span or more.
6. Side Laps: Overlapped.

### 2.3 COMPOSITE FLOOR DECK

A. **Manufacturers:** Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

1. ASC Profiles, Inc.; a Blue Scope Steel company.
2. Canam United States; Canam Group Inc.
3. CMC Joist & Deck.
4. Consolidated Systems, Inc.; Metal Dek Group.
5. Cordeck.
6. DACS, Inc.
7. Epic Metals Corporation.
8. Marlyn Steel Decks, Inc.
9. New Millennium Building Systems, LLC.
10. Nucor Corp.; Vulcraft Group.
11. Roof Deck, Inc.
12. Verco Manufacturing Co.
13. Wheeling Corrugating Company; Div. of Wheeling-Pittsburgh Steel Corporation.

B. Composite Floor Deck: Fabricate panels, with integrally embossed or raised pattern ribs and interlocking side laps, to comply with "SDI Specifications and Commentary for Composite Steel Floor Deck," in SDI Publication No. 31, with the minimum section properties indicated, and with the following:

1. Galvanized-Steel Sheet: ASTM A 653/A 653M, Structural Steel (SS), Grade 33 (230), G60 (Z180)zinc coating.
2. Profile Depth: As indicated.

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3. Design Uncoated-Steel Thickness: As indicated
4. Span Condition: Triple span or more.

### 2.4 ACCESSORIES

- A. General: Provide manufacturer's standard accessory materials for deck that comply with requirements indicated.
- B. Mechanical Fasteners: Corrosion-resistant, low-velocity, power-actuated or pneumatically driven carbon-steel fasteners; or self-drilling, self-threading screws.
- C. Side-Lap Fasteners: Corrosion-resistant, hexagonal washer head; self-drilling, carbon-steel screws, No. 10 (4.8-mm) minimum diameter.
- D. Flexible Closure Strips: Vulcanized, closed-cell, synthetic rubber.
- E. Miscellaneous Sheet Metal Deck Accessories: Steel sheet, minimum yield strength of 33,000 psi (230 MPa), not less than 0.0359-inch (0.91-mm) design uncoated thickness, of same material and finish as deck; of profile indicated or required for application.
- F. Pour Stops and Girder Fillers: Steel sheet, minimum yield strength of 33,000 psi (230 MPa), of same material and finish as deck, and of thickness and profile recommended by SDI Publication No. 31 for overhang and slab depth.
- G. Column Closures, End Closures, Z-Closures, and Cover Plates: Steel sheet, of same material, finish, and thickness as deck unless otherwise indicated.
- H. Recessed Sump Pans: Single-piece steel sheet, 0.0747 inch (1.90 mm) thick, of same material and finish as deck, with 3-inch- (76-mm-) wide flanges and level recessed pans of 1-1/2-inch (38-mm) minimum depth. For drains, cut holes in the field.
- I. Galvanizing Repair Paint: SSPC-Paint 20 or MIL-P-21035B, with dry film containing a minimum of 94 percent zinc dust by weight.
- J. Repair Paint: Manufacturer's standard rust-inhibitive primer of same color as primer.

## PART 3 - EXECUTION

### 3.1 EXAMINATION

- A. Examine supporting frame and field conditions for compliance with requirements for installation tolerances and other conditions affecting performance.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

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### 3.2 INSTALLATION, GENERAL

- A. Install deck panels and accessories according to applicable specifications and commentary in SDI Publication No. 31, manufacturer's written instructions, and requirements in this Section.
- B. Install temporary shoring before placing deck panels if required to meet deflection limitations.
- C. Locate deck bundles to prevent overloading of supporting members.
- D. Place deck panels on supporting frame and adjust to final position with ends accurately aligned and bearing on supporting frame before being permanently fastened. Do not stretch or contract side-lap interlocks.
  - 1. Align cellular deck panels over full length of cell runs and align cells at ends of abutting panels.
- E. Place deck panels flat and square and fasten to supporting frame without warp or deflection.
- F. Cut and neatly fit deck panels and accessories around openings and other work projecting through or adjacent to deck.
- G. Provide additional reinforcement and closure pieces at openings as required for strength, continuity of deck, and support of other work.
- H. Comply with AWS requirements and procedures for manual shielded metal arc welding, appearance and quality of welds, and methods used for correcting welding work.
- I. Mechanical fasteners may be used in lieu of welding to fasten deck. Locate mechanical fasteners and install according to deck manufacturer's written instructions.

### 3.3 ROOF-DECK INSTALLATION

- A. Fasten roof-deck panels to steel supporting members by arc spot (puddle) welds of the surface diameter indicated or arc seam welds with an equal perimeter that is not less than 1-1/2 inches (38 mm) long, and as follows:
  - 1. Weld Diameter: 5/8 inch (16 mm), nominal.
  - 2. Weld Spacing: Weld edge and interior ribs of deck units with a minimum of two welds per deck unit at each support. Space welds 12 inches (305 mm) apart in the field of roof and 6 inches (150 mm) apart in roof corners and perimeter, as indicated.
- B. Side-Lap and Perimeter Edge Fastening: Fasten side laps and perimeter edges of panels between supports, at intervals not exceeding the lesser of 1/2 of the span or 18 inches (457 mm)] [36 inches (914 mm), and as follows:
  - 1. Mechanically fasten with self-drilling, No. 10 (4.8-mm-) diameter or larger, carbon-steel screws.

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- C. End Bearing: Install deck ends over supporting frame with a minimum end bearing of 1-1/2 inches (38 mm), with end joints as follows:
  - 1. End Joints: Lapped 2 inches (51 mm) minimum.
- D. Roof Sump Pans and Sump Plates: Install over openings provided in roof deck and mechanically fasten flanges to top of deck. Space mechanical fasteners not more than 12 inches (305 mm) apart with at least one fastener at each corner.
- E. Miscellaneous Roof-Deck Accessories: Install ridge and valley plates, finish strips, end closures, and reinforcing channels according to deck manufacturer's written instructions. mechanically fasten to substrate to provide a complete deck installation.
  - 1. Weld cover plates at changes in direction of roof-deck panels unless otherwise indicated.
- F. Flexible Closure Strips: Install flexible closure strips over partitions, walls, and where indicated. Install with adhesive according to manufacturer's written instructions to ensure complete closure.

### 3.4 FLOOR-DECK INSTALLATION

- A. Fasten floor-deck panels to steel supporting members by arc spot (puddle) welds of the surface diameter indicated and as follows:
  - 1. Weld Diameter: 5/8 inch (16 mm), nominal.
  - 2. Weld Spacing: Weld edge ribs of panels at each support. Space additional welds an average of 12 inches (305 mm) apart, but not more than 18 inches (457 mm) apart.
  - 3. Weld Spacing: Space and locate welds as indicated.
- B. Side-Lap and Perimeter Edge Fastening: Fasten side laps and perimeter edges of panels between supports, at intervals not exceeding the lesser of half of the span or 36 inches (914 mm), and as follows:
  - 1. Mechanically fasten with self-drilling, No. 10 (4.8-mm-) diameter or larger, carbon-steel screws.
  - 2. Mechanically clinch or button punch.
  - 3. Fasten with a minimum of 1-1/2-inch- (38-mm-) long welds.
- C. End Bearing: Install deck ends over supporting frame with a minimum end bearing of 1-1/2 inches (38 mm), with end joints as follows:
  - 1. End Joints: Butted.
- D. Pour Stops and Girder Fillers: Weld steel sheet pour stops and girder fillers to supporting structure according to SDI recommendations unless otherwise indicated.

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### **3.5 FIELD QUALITY CONTROL**

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

### **3.6 PROTECTION**

- A. Galvanizing Repairs: Prepare and repair damaged galvanized coatings on both surfaces of deck with galvanized repair paint according to ASTM A 780 and manufacturer's written instructions.
- B. Repair Painting: Wire brush and clean rust spots, welds, and abraded areas on top surface of prime-painted deck immediately after installation, and apply repair paint.
- C. Provide final protection and maintain conditions to ensure that steel deck is without damage or deterioration at time of Substantial Completion.

END OF SECTION 053100

SECTION 05517

ALTERNATING TREAD STEEL STAIRS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS:

Drawings and general provisions of Contract, including General and Supplementary Conditions and Division-1 Specification sections, apply to work of this section.

1.2 SUMMARY:

A. Provide all material, labor, equipment and services and perform all operations necessary or required for the work of this section, in accordance with the Drawings and Specifications, and including fabrication and installation of Alternating Tread Steel Stairs.

B. Related work specified elsewhere includes but is not limited to:

1. Metal Fabrications in another Division 5 section
2. Painting in Division 9

1.3 PERFORMANCE REQUIREMENTS:

A. Stair Treads: be capable of withstanding a concentrated 1000 pound load without deformation

B. Handrail: be capable of withstanding a load of 200 pounds applied in any direction at any point on the rail.

1.4 CONSTRUCTION REQUIREMENTS:

A. Landings, Treads, and Mounting Base: shall be stamped and formed from single piece material. Stock shapes, hand forming, or welded remnants shall not be permitted. All stamped parts shall have integrally formed rigidizing bends and shall be spot welded to stringers of like material.

B. Welds: shall be a minimum of 8 welds per tread, and 12 welds each on the landing and mounting base. Each weld shall be quality controlled and be capable of withstanding a minimum of 2800 lbs. in shear.

C. Pedestrian Surfaces: shall be punched through with upset non-skid openings.

D. Riser Spacing: shall be equally spaced to within 3/16" for adjacent risers and to within 3/8" for any two non-adjacent risers on a stair.

E. Handrails: shall be contoured for body guidance and underarm support and shall be attached to the outside stringers and landings by bolting.

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F. Landing Reinforcement: shall be with 1/4" steel angle notched and punched and factory welded to the landing at the points of a handrail attachment.

G. Rubber Foot Divider: shall be affixed to the central portion of the landing. A rubber bumper strip shall be attached or will be provided for field attaching to the central stringer.

### 1.5 DIMENSIONS:

A. Stair Angle: 68 degrees from horizontal.

B. Vertical Drop: the change in elevation between the upper finished floor surface where the top landing will be attached and the lower finished floor surface where the base of the stair will be secured.

### 1.6 SUBMITTALS:

Dimensional Prints: shall be submitted for approval prior to fabrication.

## PART 2 - PRODUCTS

### 2.1 ACCEPTABLE MANUFACTURER:

A. Lapeyre Stair, Inc.  
220 Laitram Lane  
Harahan, LA. 70123;  
1-(800)-535-7631 or  
1-(504)-733-6009.

### 2.2 MATERIALS:

A. Carbon Steel:

1. Treads: 13 Gauge 1010/15 HRPO per ASTM A569
2. Landing & Foot Stampings: 11 Gauge 1010/15 per ASTM A569
3. Stringers: 3" x 1 3/4" x 11 Gauge 1010/15 for 56 degree stairs over 10 vertical feet and for 68 degree stairs over 12 vertical feet.
4. Handrails: 1 1/2" OD x 0.083" 1010/15 CS per ASTM A569 cold drawn, fully annealed tube per ASTM 513.

B. Miscellaneous Material:

1. Rubber Spine: Hollow neoprene
2. Rubber Foot Divider: Solid neoprene

### 2.3 FINISHES:

A. Carbon Steel:

1. Gray Primer: Powder Coat Baked Enamel

### 2.4 FABRICATION:



General: Fabricate alternating tread steel stairs to conform with performance and construction requirements, and in accordance with approved shop drawings or dimensional prints. Fabricate and shop assemble to greatest extent possible.

A. Carbon Steel: gas metal arc welded with treads spot welded to stringers and bolt-on handrails with included bolts using the specified materials.

PART 3- EXECUTION:

3.1 PREPARATIONS:

A. Coordination: Coordinate start and installation of steel alternating treads with all other related and adjacent work. Installation shall not start until the construction has progressed to the point that weather conditions and remaining construction operations will not damage stair installation.

B. Verification: Verify that dimensions and angle are correct and that substrate is in proper condition for stair installation. Do not proceed to install until all necessary corrections have been made.

3.2 INSTALLATION:

A. If bumper has not been installed at the factory, install the bumper in accordance with the manufacturer's instructions using glue supplied with the stair.

B. Prepare mounting holes.

C. Position stair with top tread at same elevation as upper finished floor or roof surface.

D. Secure stair with not less than 2 bolts or studs at top and with not less than 2 at bottom of stair.

E. Touch up with matching paint any chipped or abraded damage to factory finish.

3.3 CLEAN:

Leave work area clean and free of debris.

END OF SECTION

**SECTION 07100**  
**DAMPPROOFING AND WATERPROOFING**

**PART 1 GENERAL**

1.01 SUMMARY

- A. Section Includes:
  - 1. Under-Slab-On-Grade Vapor Retarder
  - 2. Below grade foundation waterproofing
  
- B. Related Sections:
  - 1. Section 03300 - Cast-In-Place Concrete
  - 2. Section 04200 - Unit Masonry
  - 3. Section 07200 – Thermal Protection

1.02 SYSTEM DESCRIPTION

- A. General: Provide waterproofing that prevents the passage of liquid water under hydrostatic pressure and complies with requirements as demonstrated by testing performed by an independent testing agency of manufacturer's current sheet membrane.
- B. Provide waterproofing at slab on grade and at elevator pit.

1.03 SUBMITTALS

- A. Submit "Letter of Conformance" with the following supporting data:
  - 1. Include product data on each type of dampproofing and waterproofing product specified, including data substantiating that materials comply with specified requirements.
    - a. Mark each copy to identify applicable products, characteristics, models, options and other supplemental data to clearly communicate information specific to this project.
- B. Samples, 3 x 6 inches minimum size, of each fluid-applied and sheet membrane waterproofing material specified for Project.

1.04 QUALITY ASSURANCE

- A. Installer Qualifications: Engage an experienced Installer who has completed fluid-applied and sheet membrane waterproofing applications similar in material, design, and extent to that indicated for Project and that has resulted in construction with a record of successful in-service performance.
  - 1. Assign work closely associated with waterproofing, including (but not limited to) waterproofing accessories, and flashings used in conjunction with waterproofing, expansion joints in membrane, insulation, and protection course on membrane, to Installer of fluid-applied waterproofing, for single, undivided responsibility.
- B. Single-Source Responsibility: Obtain primary waterproofing materials of each type required from a single manufacturer.
- C. Pre-Installation Conference: A pre-installation conference shall be held prior to commencement of field operations to establish procedures to maintain optimum working conditions and to coordinate this work with related and adjacent work. Agenda for meeting shall include review of special details and flashing.

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### 1.05 DELIVERY, STORAGE, AND HANDLING

- A. Deliver materials to Project site in original packages with seals unbroken, labeled with manufacturer name, product, date of manufacture, and directions for storage.
- B. Store materials in their original undamaged packages in a clean, dry, protected location and within temperature range required by waterproofing manufacturer. Protect stored materials from direct sunlight.

### 1.06 PROJECT CONDITIONS

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

## PART 2 PRODUCTS

### 2.01 MATERIALS, GENERAL

- A. General Compatibility: Provide products that are recommended by manufacturer to be fully compatible with indicated substrates.

### 2.02 UNDER-SLAB-ON-GRADE VAPOR RETARDER:

- A. Vapor Retarder Under-Slabs-On-Grade:
  - a. Polyethylene vapor barrier material shall be placed under all concrete slabs on grade. Provide in lengths and widths required for least number of seams.
  - b. Vapor barrier minimum thickness of ten (10) mils.
  - c. Lap all joints minimum six (6) inches and seal with mastic or tape. All pipe penetrations sealed with tape.
  - d. Vapor-Retarder Tape: Pressure-sensitive tape of type recommended by vapor retarder manufacturer for sealing joints and penetrations in vapor retarder.

### 2.03 BELOW GRADE FOUNDATION WATERPROOFING & ELEVATOR PIT:

- A. Waterproofing:
  - 1. Trowel applied waterproofing membrane.
  - 2. Manufacturers:
    - a. "Thorseal Foundation Coating, No. T1180"; Thoro Consumer Products (216-839-7171)
    - b. Or equal.

### 2.04 MISCELLANEOUS MATERIALS

- A. In addition to primary waterproofing materials, provide the following:
  - 1. Primer/Filler/Sealer: As recommended by waterproofing manufacturer.
  - 2. Flashings, Cant Strips, and Accessories: As recommended by waterproofing manufacturer.

## **PART 3 EXECUTION**

### **3.01 EXAMINATION**

- A. Examine substrates, areas, and conditions under which waterproofing systems will be applied, with Installer present, for compliance with requirements. Do not proceed with installation until unsatisfactory conditions have been corrected.
  - 1. Do not proceed with installation until after minimum concrete curing period recommended by waterproofing manufacturer.
  - 2. Verify substrate is visibly dry and free of moisture. Test for capillary moisture by plastic sheet method according to ASTM D4263.
- B. Inspect concrete and concrete masonry surfaces for:
  - 1. Contamination: Algae, chalkiness, dirt, dust, efflorescence, form oil, fungus, grease, mildew or other foreign substances.
  - 2. Surface absorption and chalkiness.
  - 3. Cracks: Measure crack width and record location of cracks.
  - 4. Damage and deterioration.
  - 5. Moisture content and moisture damage:
    - a. Use a moisture meter to determine if the surface is dry enough to receive the air and moisture barrier and record any areas of moisture damage or excess moisture.
  - 6. Compliance with specification tolerances:
    - a. Record areas that are out of tolerance (greater than 1/4 inch in 8-0 feet deviation in plane).
- C. Notify Architect in writing of anticipated problems using waterproofing over substrate.

### **3.02 PREPARATION**

- A. Clean substrate of projections and substances detrimental to work; comply with instructions of prime materials manufacturer.
- B. Install cant strips and similar accessories as shown and as recommended by prime materials manufacturer even though not shown.
- C. Fill voids, seal joints, and apply bond breakers as recommended by prime materials manufacturer.
- D. Prime substrate as recommended by prime materials manufacturer.

### **3.03 INSTALLATION - GENERAL**

- A. Comply with manufacturer's written installation recommendations, including preparation of substrate surfaces, detail coatings of joints and planar changes in substrate, and priming of substrates.
- B. Mix separately packaged components in accordance with manufacturer's written recommendations.

### **3.04 INSTALLATION - UNDER-SLAB-ON-GRADE VAPOR RETARDER**

- A. General: Extend vapor and moisture barriers to extremities of areas to be protected from vapor transmission. Extend vapor and moisture barriers to cover miscellaneous voids in insulated substrates, including those which have been stuffed with loose fiber-type insulation.

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- B. Seal joints caused by pipes, conduits, electrical boxes, and similar items penetrating vapor retarders with vapor-retarder tape of type recommended by vapor retarder manufacturer to create an air-tight seal between penetrating objects and vapor retarder.
- C. Repair any tears or punctures in vapor and moisture barriers immediately before concealment by other work. Cover with vapor-retarder tape or another layer of vapor retarder.

### **3.05 PROTECTING AND CLEANING**

- A. Protect waterproofing from damage and wear during application and remainder of construction period, according to manufacturer's written instructions.
- B. Clean spillage and soiling from adjacent construction using cleaning agents and procedures recommended by manufacturer of affected construction.

**END OF SECTION**

## SECTION 07211

### FOAM BOARD AND BATT INSULATION

#### PART 1 - GENERAL

##### 1.1 SUMMARY

- A. Section includes: Thermal, air and water resistive barrier wall system for cold-formed metal exterior wall assemblies:
1. Exterior wall steel stud cavity batt insulation.
  2. Exterior wall insulating sheathing.
- B. Related Sections:
1. Section 05 41 00, Structural Metal Stud Framing.
  2. Section 09 21 16, Gypsum Board Assemblies.
  3. Section 07 26 13, Above Grade Vapor Retarders.
  4. Section 07 27 23, Board Product Air Barriers.

##### 1.2 REFERENCES

- A. Materials shall meet the property requirements of one or more of the following specifications as applicable to the specific product or end use:
1. American Society for Testing of Materials (ASTM):
    - a. ASTM C 272: Standard Test Method for Water Absorption of Core Materials for Structural Sandwich Constructions.
    - b. ASTM C 518: Standard Test Method for Steady-State Thermal Transmission Properties by Means of the Heat Flow Meter Apparatus.
    - c. ASTM C 578: Standard Specification for Rigid Cellular Polystyrene Thermal Insulation.
    - d. ASTM C 665: Standard Specification for Mineral-Fiber Blanket Thermal Insulation for Light Frame Construction and Manufactured Housing.
    - e. ASTM D 1621: Standard Test Method for Compressive Properties of Rigid Cellular Plastics.
    - f. ASTM E 84: Standard Test Method for Surface Burning Characteristics of Building Materials.
    - g. ASTM E 96: Standard Test Methods for Water Vapor Transmission of Materials.
    - h. ASTM E 119: Standard Test Methods for Fire Tests of Building Constructions and Materials.
    - i. ASTM E 331: Standard Test Method for Water Penetration of Exterior Windows, Skylights, Doors and Curtain Walls by Uniform Static Air Pressure Difference.
    - j. ASTM E 2178: Standard Test Method for Air Permeance of Building Materials.
  2. National Fire Protection Association (NFPA):
    - a. NFPA 285: Standard Fire Method for Evaluation of Fire Propagation Characteristics of Exterior Non-Load-Bearing Wall Assemblies Containing Combustible Components.
  3. International Code Council Evaluation Service (ICC -ES):
    - a. AC 71: Acceptance Criteria for Foam Plastic Sheathing Panels Used as Water Resistive Barriers.
    - b. AC 148: Acceptance Criteria for Flexible Flashing Materials.
  4. American Architectural Manufacturers Association (AAMA):
    - a. AAMA 711: Voluntary Specification for Self Adhering Flashing Used for Installation of Exterior Wall Fenestration Products.

##### 1.3 SYSTEM DESCRIPTION

- A. Provide and install cold formed steel stud exterior wall framing, non-load bearing, fire resistance rated, and non-rated system, with exterior gypsum sheathing, with spray applied air and water resistive barrier layer over the exterior gypsum, with continuous insulation sheathing, foam board joints sealed with fiberglass

batt insulation in the stud cavity, without a vapor retarding facer on the fiberglass ,that effectively controls thermal, air and water performance and provides continuous insulation and continuity of the building envelope.

All joints, penetrations and gaps of the insulating [and air barrier] wall system shall be made water [and air] tight.

- B. Code Compliance: Exterior wall system and component materials shall comply with the following requirements:
1. **The complete exterior wall assembly shall comply with the passing criteria defined in NFP A 285 for exterior wall limited fire spread performance.**
  2. **Wall and floor joints shall be fire stopped as required in International Building Code Section 714.**
  3. **Insulating sheathing and foam joint sealing tapes shall comply with ASTM E 2178, AC71 and AC148 for exterior wall products sealed against air and water penetration.**

#### 1.4 SUBMITTALS

- A. Product Data: Submit data on product characteristics, performance criteria, and limitations, including installation instructions.
- B. Sustainable Design: Submit manufacturer's sustainable design certifications as indicated.
- C. Warranty: Submit documentation for limited product warranty. [ \_\_\_ years or lifetime].

#### 1.5 QUALITY ASSURANCE

- A. Each insulation board must be labeled with manufacturer's name, product brand name, ASTM material specification reference, and identification of the third party inspection agency used for building code qualification.

#### 1.6 DELIVERY, STORAGE, AND HANDLING

- A. Deliver materials in manufacturer's original packaging.
- B. Store and protect products in accordance with manufacturer's instructions. Store in a dry area and protect from water, direct sunlight, flame, and ignition sources. Do not install insulation that has been damaged or wet.
1. **In the event the board insulation becomes wet, wipe dry prior to installation.**
  2. **In the event the batt or blanket insulation becomes wet, remove it from jobsite.**
    - a. **An exception may be allowed in cases where the contractor is able to demonstrate that wet insulation when fully dried out (either before installation or afterward following exposure to system operating temperatures) will provide installed performance that is equivalent in respects to new, completely dry insulation. In such cases, consult the insulation manufacturer for technical assistance.**

### PART 2 - PRODUCTS

#### 2.1 MANUFACTURER

#### SCHEDULE 1 - PRODUCTS

#### PRODUCT DATA SHEET 0 - MANUFACTURERS

- 2.1 Extruded Polystyrene Foam Board Insulation - Foundation Walls and Under Slab.
1. "Styrofoam Square Edge"; 2", [Dow Chemical Company](#) (800-441-436)

**2.2 Batt Insulation: Fiberglass by Owens Corning or equal. See Drawings for thickness.**

- A. Owens Corning Insulating Systems, LLC, Toledo, OH 43659; www.owenscorning.com.

**2.3 Manufacturers: Subject to compliance with product criteria, the manufacturers whose products may be incorporated into the work include but are not limited to:**

1. **DiversiFoam Products.**
2. **Dow Chemical Company.**
3. **Owens Corning.**
4. **Pactiv Corporation.**

- B. Fasteners: Provide preassembled screw/stress plate fasteners recommended by their manufacturer for securing foam plastic insulating sheathing. Polymer or other corrosion-protected, coated steel screw fasteners for anchoring sheathing to metal wall framing. Fastener length and size based on wall sheathing thickness and fastener manufacturer recommendation.

**2.4 FIBER GLASS BATT INSULATION**

- A. Stud Cavity Batts: Fiberglass batt insulation [unfaced], complying with ASTM C665 and meeting the following criteria:

1. **ASTM C 665 type I (batt without facing), flame spread 25 or less, or III Class A (batt with reflective facing, flame spread 25 or less).**
2. **Full width batt for use with steel studs spaced 16", & 24" on center.**
3. **Thermal Resistance: Measured in accordance with ASTM C 518, R-value = 13, Unfaced.**
4. **Indoor Air Quality: Verified to be formaldehyde free by independent third party such as GreenGuard Environmental Institute, Indoor Air Quality and/or GreenGuard Children and Schools Certified**

- B. Manufacturers: Subject to compliance with product criteria, the manufacturers whose products may be incorporated into the work include but are not limited to:

1. **CertainTeed Corporation.**
2. **Guardian Building Products.**
3. **Johns Manville.**
4. **Owens Corning.**

- C. Acceptable Products: Subject to compliance with product criteria, the products that may be incorporated into the work include but are not limited to:

1. **Ec oTouch™ Thermal Batt, unfaced;**
  - a. **ASTM C 665 Type I; thickness , 3-1/2" R-13, full width for steel stud framing 16" or 24" on center; 48" or 96" long ]**

- D. [Manufacturers: Subject to compliance with product criteria, the manufacturers whose products may be incorporated into the work include but are not limited to:

1. **Owens Corning.]**

**PART 3 - EXECUTION**

**3.1 EXAMINATION**

- A. Verify that steel wall studs, opening framing, bridging and structural bracing and other framing support members and anchorage have been installed in accordance with good construction practice and are compliant with this specification.



- B. Verify that adjacent materials are dry and ready to receive insulation. Verify mechanical and electrical services within walls have been tested and inspected.
- C. Report unacceptable conditions in writing. Do not proceed with work until unsatisfactory conditions have been corrected.
- D. Installation of products specified in this section constitutes acceptance of existing conditions and assumption of responsibility for satisfactory performance.

**3.2 INSTALLATION OF FIBER GLASS BATT STEEL STUD CAVITY INSULATION**

- A. Install fiberglass batt insulation in accordance with manufacturer's recommendations and not before the exterior sheathing has been installed on one side of the stud cavity and sealed to be water resistant.
- B. Protect insulation from damage due to weather and physical abuse until protected by permanent construction.
- C. Fit batt insulation tightly into exterior wall steel stud cavity spaces and framing voids to create a continuous insulation layer without gaps. Trim to fill spaces and voids neatly. Fluff insulation to full thickness for specified R-value before installation. Do not compress insulation.
- D. Within exterior wall framing, install insulation between pipes, mechanical services, electrical boxes, and backside of sheathing. Cut or split insulation material as required to fit around wiring and plumbing.
- E. Fiberglass batt support in steel stud cavities:
  - 1. **Unfaced batt : Tightly friction fit full width 16", or full width 24", batt insulation to fill the interior of the cavities between steel studs, and to completely fill the voids inside the steel stud flanges.**
  - 2. **Unfaced batt insulation, completely filled cavity depth, both sides of the stud cavity closed: Friction fit is adequate if the insulation completely fills the depth of the stud cavity, and the cavity is enclosed on both sides. No additional support is required**
  - 3. **Unfaced batt insulation, completely filled cavity depth, one side of the stud cavity open : Friction fit, supplement with straps or wires, described below, installed starting 4' above the floor and every 2' on center above 4'.**
  - 4. **Unfaced batt insulation, does not completely fill depth of stud cavity : Friction fit, supplement with straps or wires, described below, installed starting 4' above the floor and every 2' on center above 4'.**
  - 5. **Supplemental wire or strap supporting devices]: Multiple types of support devices may be used. Wires can be inserted through the batts extending from stud to stud. The wires may be installed continuously through the punch outs of the steel stud framing. Or, heavy gauge wire may be cut slightly larger than each stud space and wedged into place between studs. When the insulation is less than the depth of the stud cavity, the wires should be positioned to hold the batt against the sheathing (gypsum or foam plastic) on the opposite side of the cavity. Another option is the use of punched metal straps attached to the face of the framing. The punched pronged tabs are bent 90 degrees pointing into the stud cavity and are pushed into the insulation after installation. The punched prongs impale the insulation batt and hold it in place.**

END OF SECTION

**DRYVIT SYSTEMS, INC.**  
**ARCHITECTURAL SPECIFICATION**  
**SECTION 07240**  
**OUTSULATION® X SYSTEM**  
**EXTERIOR INSULATION AND FINISH SYSTEM**

**PART I - GENERAL**

**1.01 SUMMARY:**

A. This document is intended to be used in preparing specifications for projects utilizing the Dryvit Outsulation X System Exterior Insulation and Finish System (EIFS) with moisture drainage provisions. For complete product description and usage refer to:

1. Dryvit Outsulation X System Application Instructions. DS836
2. Dryvit Outsulation X System Installation Details, DS837
3. Dryvit Outsulation X System Data Sheet, DS834

B. Related Sections

1. Unit Masonry – Section 04200
2. Concrete – Sections 03300 and 03400
3. Light Gauge Cold Formed Steel Framing – Section 05400
4. Wood Framing – Section 06100
5. Sealant – Section 07900
6. Flashing – Section 07600

**1.02 REFERENCES**

A. Section Includes

1. ASTM B 117 (Federal Test Standard 141A Method 6061) Standard Practice for Operating Salt Spray (Fog) Apparatus
2. ASTM C 67 Standard Test Methods for Sampling and Testing Brick and Structural Clay Tile
3. ASTM C 150 Standard Specification for Portland Cement
4. ASTM C 203 Standard Test Methods for Breaking Load and Flexural Properties of Block-Type Thermal Insulation
5. ASTM C 272 Standard Test Method for Water Absorption of Core Materials for Structural Sandwich Constructions
6. ASTM C 273 Standard Test Method for Shear Properties of Sandwich Core Materials
7. ASTM C 297 Standard Test Method for Flatwise Tensile Strength of Sandwich Constructions
8. ASTM C 518 Standard Test Method for Steady-State Thermal Transmission Properties by Means of the Heat Flow Meter Apparatus
9. ASTM C 1177 Standard Specification for Glass Mat Gypsum Substrate for Use as Sheathing
10. ASTM D 968 (Federal Test Standard 141A Method 6191) Standard Test Methods for Abrasion Resistance of Organic Coatings by Falling Abrasive
11. ASTM D 1621 Standard Test Method for Compressive Properties Of Rigid Cellular Plastics
12. ASTM D 1622 Standard Test Method for Apparent Density of Rigid Cellular Plastics
13. ASTM D 1623 Standard Test Method for Tensile and Tensile Adhesion Properties of Rigid Cellular Plastics
14. ASTM D 2247 (Federal Test Standard 141A Method 6201) Standard Practice for Testing Water Resistance of Coatings in 100% Relative Humidity
15. ASTM D 2863 Standard Test Method for Measuring the Minimum Oxygen Concentration to Support Candle-Like Combustion of Plastics (Oxygen Index)
16. ASTM D 3273 Standard Test Method for Resistance to Growth of Mold on the Surface of Interior Coatings in an Environmental Chamber
17. ASTM D 4060 Standard Test Method for Abrasion Resistance of Organic Coatings by the Taber Abraser
18. ASTM E 72 Standard Test Methods of Conducting Strength Tests of Panels for Building Construction
19. ASTM E 84 Standard Test Method for Surface Burning Characteristics of Building Materials
20. ASTM E 96 Standard Test Methods for Water Vapor Transmission of Materials
21. 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
22. ASTM E 330 Test Method for Structural Performance of Exterior Windows, Doors and Curtain Walls by Uniform Static Air Pressure Difference

23. ASTM E 331 Test Method for Water Penetration of Exterior Windows, Skylights, Doors and Curtain Walls by Uniform Static Air Pressure Difference
24. ASTM E 1233 Standard Test Method for Structural Performance of Exterior Windows, Doors, Skylights, and Curtain Walls by Cyclic Air Pressure Differential
25. ASTM E 2098 Test Method for Determining the Tensile Breaking Strength of Glass Fiber Reinforcing Mesh for use in Class PB Exterior Insulation and Finish Systems (EIFS), after Exposure to Sodium Hydroxide Solution
26. ASTM E 2134 Test Method for Evaluating the Tensile-Adhesion Performance of Exterior Insulation and Finish Systems (EIFS)
27. ASTM E 2178 Standard Test Method for Air Permeance of Building Materials
28. ASTM E 2273 Test Method for Determining the Drainage Efficiency of Exterior Insulation and Finish Systems (EIFS) Clad Wall Assemblies
29. ASTM E 2357 Standard Test Method for Determining Air Leakage of Air Barrier Assemblies
30. ASTM E 2485 (formerly EIMA Std. 101.01) Standard Test Method for Freeze-Thaw Resistance of Exterior Insulation and Finish Systems (EIFS) and Water-Resistive Barrier Coatings
31. ASTM E 2486 (formerly EIMA Std. 101.86) Standard Test Method for Impact Resistance of Class PB and PI Exterior Insulation and Finish Systems (EIFS)
32. ASTM E 2570 Standard Test Methods for Evaluating Water-Resistive Barrier (WRB) Coatings Used under Exterior Insulation and Finish Systems (EIFS) or EIFS with Drainage
33. ASTM G 154 Standard Practice for Operating Fluorescent Light Apparatus for UV Exposure of Nonmetallic Materials
34. ASTM G 155 (Federal Test Standard 141A Method 6151) Standard Practice for Operating-Xenon Arc Light Apparatus for Exposure of Nonmetallic Materials
35. DS151, Custom Brick™ Polymer System Specifications for Use On Vertical Walls
36. DS152, Dryvit Cleaning and Recoating
37. DS153, Dryvit Expansion Joints and Sealants
38. DS159, Dryvit Water Vapor Transmission
39. DS494, Dryvit AquaFlash® System
40. DS705, Reflectit™
41. DS706, Mojave E™ Finish
42. NFPA 268 Standard Test Method for Determining Ignitibility of Exterior Wall Assemblies Using a Radiant Heat Energy Source.
43. NFPA 285 Standard Method of Test for the Evaluation of Flammability Characteristics of Exterior Non-Load-Bearing Wall Assemblies Containing Combustible Components Using the Intermediate-Scale, Multistory Test Apparatus
44. AATCC 127 Water Resistance: Hydrostatic Pressure Test
45. M.O.A.T 22 UEAtc Directives for Assessment of External Insulation systems for Walls (Expanded Polystyrene Insulation Faced with a Thin Rendering)

### 1.03 DEFINITIONS

- A. Base Coat: Material used to encapsulate one or more layers of reinforcing mesh fully embedded that is applied to the outside surface of the Dow® XENERGY™ Rigid Insulation Board.
- B. Building Expansion Joint: A joint through the entire building structure designed to accommodate structural movement.
- C. Contractor: The contractor that installs the Outsulation X System to the substrate.
- D. Dryvit: Dryvit Systems, Inc., the manufacturer of certain components of the Outsulation X System, a Rhode Island corporation.
- E. Expansion Joint: A structural discontinuity in the Outsulation X System.
- F. Finish: An acrylic-based coating, available in a variety of textures and colors that is applied over the base coat.
- G. Insulation Board: Dow XENERGY Rigid Insulation Board with factory planed surfaces which is affixed to the substrate and creates a layer of continuous insulation.
- H. Panel Erector: The contractor who installs the panelized Outsulation X System.
- I. Panel Fabricator: The contractor who fabricates the panelized Outsulation X System.
- J. Reinforcing Mesh: Glass fiber mesh(es) used to reinforce the base coat and to provide impact resistance.
- K. Sheathing: A substrate in sheet form.
- L. Substrate: The material to which the Outsulation X System is affixed.
- M. Substrate System: The total wall assembly including the attached substrate to which the Outsulation X System is affixed.

## 1.04 SYSTEM DESCRIPTION

- A. General: The Dryvit Outsulation X System is an Exterior Insulation and Finish System (EIFS), consisting of an air/water-resistive barrier coating, an adhesive, extruded polystyrene insulation board, mechanical fasteners, fiber reinforced polymer modified base coat with reinforcing mesh(es) and finish.
- B. Methods of Installation:
1. Field Applied: The Outsulation X System is applied to the substrate system in place.
  2. Panelized: The Outsulation X System is shop-applied to the prefabricated wall panels.
- C. Design Requirements:
1. Acceptable substrates for the Outsulation X System shall be:
    - a. Exterior grade gypsum sheathing having a water-resistant core with fiberglass mat facers meeting ASTM C 1177 at the time of application of the Outsulation X System.
    - b. Exterior fiber reinforced cement or calcium silicate boards.
    - c. APA Exterior or Exposure 1 Rated Plywood, Grade C-D or better, nominal 12.7 mm (1/2 in), minimum 4-ply.
    - d. Unglazed brick, cement plaster, concrete, or masonry.
    - e. APA Exposure 1 rated Oriented Strand Board (OSB), nominal 12.7 mm (1/2 in).
    - f. Galvanized expanded metal lath 1.4 or 1.8 kg/m<sup>2</sup> (2.5 or 3.4 lbs/yd<sup>2</sup>) installed over a solid substrate.
  2. Deflection of substrate systems shall not exceed 1/240 times the span.
  3. The substrate shall be flat within 6.4 mm (1/4 in) in a 1.2 m (4 ft) radius.
  4. The slope of inclined surfaces shall not be less than 6 in 12 (27°), and the length shall not exceed 305 mm (12 in).
  5. At horizontal sealant joints and window sills projecting 102 mm (4 in or less), the slope shall not be less than 3:12.
  6. All areas requiring an impact resistance classification higher than "Medium", as defined by ASTM E 2486 (formerly EIMA Standard 101.86), shall be as detailed in the drawings and described in the contract documents. Refer to Section 1.04.D.1.d of this specification.
  7. Expansion joints:
    - a) Design and location is the responsibility of the designer. As a minimum, expansion joints are required at the following locations:
      - 1) Where expansion joints occur in the substrate system.
      - 2) Where building expansion joints occur.
      - 3) At floor lines in wood frame construction.
      - 4) Where the Outsulation X System abuts dissimilar materials.
      - 5) Where the substrate type changes.
      - 6) In continuous elevations at intervals not exceeding 15 m (50 ft).
      - 7) Where significant structural movement occurs such as changes in roof line, building shape or structural system.
      - 8) At floor lines of non-wood framed buildings where significant movement is expected.
      - 9) Where prefabricated panels abut one another.
  8. Terminations
    - a. Prior to applying the Dryvit Outsulation X System, wall openings shall be treated with Dryvit AquaFlash System or Flashing Tape. Refer to Dryvit Outsulation X Installation Details DS837.
    - b. The Outsulation X System shall be held back from adjoining materials around openings and penetrations such as windows, doors, and mechanical equipment a minimum of 19 mm (3/4 in) for sealant application. See Dryvit's Outsulation X System Installation Details DS837.
    - c. The system shall be terminated a minimum of 203 mm (8 in) above finished grade or 19 mm (3/4 in) above curbing and walkways.
  9. Sealants
    - a. Shall be manufactured and supplied by others.
    - b. Shall be compatible with the Outsulation X System materials. Refer to current Dryvit Publication DS153 for listing of sealants tested by sealant manufacturer for compatibility.
    - c. The sealant backer rod shall be closed cell.
  10. Vapor Retarders
    - a. Use and location of vapor retarders within a wall assembly is the responsibility of the project designer and shall comply with local building code requirements. Type and location shall be noted on the project drawings and specifications. Vapor retarders/barriers may be inappropriate in certain walls and climatic areas and can result in condensation within the wall assembly.

11. Dark Colors: The use of dark colors must be considered in relation to wall surface temperature as a function of local climate conditions. Use of dark colors in high temperature climates can affect the performance of the system.

12. Flashing: Shall be provided at all roof-wall intersections, windows, doors, chimneys, decks, balconies, and other areas as necessary to prevent water from entering behind the Outsulation X System.

D. Performance Requirements

1. The Outsulation X System shall have been tested as follows:

a. Air/Water-Resistive Barrier Coating

TEST	TEST METHOD	CRITERIA	RESULTS
<b>Tensile Bond</b>	ASTM C 297/E 2134 ICC ES (AC 212)*	Minimum 104 kPa (15 psi)	Substrate: Minimum 167 kPa (24.2 psi) (Backstop NT)  Flashing Minimum 2970 kPa (431 psi) (Backstop NT)
<b>Freeze-thaw</b>	ASTM E 2485/ICC-ES Procedure ICC ES (AC 212)*	No deleterious effects after 10 cycles	Passed - No deleterious effects after 10 cycles
<b>Water Resistance</b>	ASTM D 2247 ICC ES (AC 212)*	No deleterious effects after 14 days exposure	No deleterious effects after 14 days exposure
<b>Water Vapor Transmission</b>	ASTM E 96 Proc. B ICC ES (AC 212)*	Class III Vapor Barrier	7 perms (Backstop NT)
<b>Air Leakage</b>	ASTM E 283	No Criteria	0.6 l/min/m <sup>2</sup> (0.002 cfm/ft <sup>2</sup> )
<b>Air Permeance</b>	ASTM E 2178	No ICC or ANSI/EIMA Criteria	0.0006 l/s/m <sup>2</sup> @ 75Pa (1.2x10 <sup>-4</sup> cfm/ft <sup>2</sup> @ 1.6 psf) (Backstop NT)
<b>Air Barrier Assembly</b>	ASTM E 2357	No ICC or ANSI/EIMA Criteria	0.05 l/sec m <sup>2</sup> @300 Pa (<0.001 cfm/ft <sup>2</sup> @ 6.24 psf) (Backstop NT)
<b>Structural Performance</b>	ASTM E 1233 Proc. A ICC ES (AC 212)*	Minimum 10 positive cycles at 1/240 deflection; No cracking in field, at joints or interface with flashing	Passed
<b>Racking</b>	ASTM E 72 ICC ES (AC 212)*	No cracking in field, at joints or interface with flashing at net deflection of 3.2 mm (1/8 inch)	Passed
<b>Restrained Environmental</b>	ICC-ES Procedure ICC ES (AC 212)*	5 cycles; No cracking in field, at joints or interface with flashing	Passed
<b>Water Penetration</b>	ASTM E331 ICC ES (AC 212)*	No water penetration beyond the inner-most plane of the wall after 15 minutes at 137 Pa (2.86 psf)	Passed
<b>Weathering UV Exposure</b>	ICC ES Proc. ICC ES (AC212)*	210 hours of exposure	Passed
<b>Accelerated Aging</b>	ICC ES Proc. ICC ES (AC212)*	25 cycles of drying and soaking  21.6" water column for 5 hours	Passed
<b>Hydrostatic Pressure Test</b>	AATCC 127 ICC ES (AC212)*		Passed
<b>Surface Burning Characteristics</b>	ASTM E 84	Flame Spread < 25 Smoke Developed < 450	Passed

\*AC 212 – Acceptance Criteria for Water-Resistive Coatings Used as Water-Resistive Barriers Over Exterior Sheathing, also referred to as ASTM E 2570.

## b. Durability

TEST	TEST METHOD	CRITERIA	RESULTS
<b>Abrasion Resistance</b>	ASTM D 968	No deleterious effects after 500 liters (528 quarts)	No deleterious effects after 1000 liters (1056 quarts)
<b>Accelerated Weathering</b>	ASTM G 155 Cycle 1	No deleterious effects after 2000 hours	No deleterious effects after 5000 hours
	ASTM G 154 Cycle 1 (QUV)		No deleterious effects after 5000 hours
<b>Freeze-Thaw Resistance</b>	ASTM E 2485 (formerly EIMA 101.01)	No deleterious effects after 60 cycles	Passed - No deleterious effects after 90 cycles
	ASTM C 67 modified	No deleterious effects after 60 cycles	Passed - No deleterious effects after 60 cycles
	ASTM E 2485/ICC-ES Proc. ICC ES (AC235)***	No deleterious effects after 10 cycles	Passed - No deleterious effects after 10 cycles
<b>Mildew Resistance</b>	ASTM D 3273	No growth during 28 day exposure period	No growth during 60 day exposure period
<b>Water Resistance</b>	ASTM D 2247	No deleterious effects after 14 days exposure	No deleterious effects after 42 days exposure
<b>Taber Abrasion</b>	ASTM D 4060	N/A	Passed 1000 cycles
<b>Salt Spray Resistance</b>	ASTM B 117	No deleterious effects after 300 hours exposure	No deleterious effects after 1000 hours exposure
<b>Drainage Efficiency</b>	ASTM E 2273 ICC ES (AC 235)***	Minimum Drainage Efficiency of 90%	Average Drainage Efficiency: 99.5%
<b>Water Penetration</b>	ASTM E 331 ICC ES (AC 235)***	No water penetration beyond the inner-most plane of the wall after 15 minutes at 137 Pa (2.86 psf)	Passed 15 minutes at 137 Pa (2.86 psf)
<b>Water Vapor Transmission</b>	ASTM E 96 Procedure B	Vapor permeable	Base Coat* 20 Perms Finish** 40 Perms
<b>Alkali Resistance of Reinforcing Mesh</b>	ASTM E 2098 (formerly EIMA 105.01)	> 21dN/cm (120 pli) retained tensile strength after exposure	Passed
<b>Hygrothermal test</b>	Moat 22 80 cycles heat/rain 5 cycles heat/cold	No visible cracks or other distress	Passed
<b>Puncture Resistance</b>	Lab Procedure	N/A	30.6 lbs
* Base Coat perm value based on Dryvit Genesis			
** Finish perm value based on Dryvit Quarzputz			
*** AC 235 – Acceptance Criteria for EIFS Clad Drainage Wall Assemblies			

## c. Structural

TEST	TEST METHOD	CRITERIA	RESULTS
<b>Tensile Bond</b>	ASTM C 297/ E 2134	Minimum 104 kPa (15 psi) – substrate or insulation failure	Min. 167 kPa (24.2 psi)
<b>Transverse Load</b>	ASTM E 330	Metal framing at 406 mm(16 in) o-c	Min. 5.55 kPa (116 psf)
		Wood framing at 406 mm(16 in) o-c	Min 9.05 kPa (189 psf)

d. Impact Resistance: In accordance with ASTM E 2486 (formerly EIMA Standard 101.86):

Reinforcing Mesh <sup>1</sup> /Weight g/m <sup>2</sup> (oz/yd <sup>2</sup> )	Minimum Tensile Strengths	EIMA Impact Classification	EIMA Impact Range Joules (in-lbs)	Impact Test Results Joules (in-lbs)
Standard Plus - 203 (6)	36 g/cm (200 lbs/in).	Medium	6-10 (50-89)	9 (76)
1. It shall be colored blue for product identification bearing the Dryvit logo.				

e. Fire

TEST	TEST METHOD	CRITERIA	RESULTS
<b>Ignitability</b>	NFPA 268	No ignition at 12.5 kw/m <sup>2</sup> at 20 minutes	Passed
<b>Intermediate Multi-Story Fire Test</b>	NFPA 285 (UBC 26-9)	1. Resist flame propagation over the exterior surface 2. Resist vertical spread of flame within combustible core/component of panel from one story to the next 3. Resist vertical spread of flame over the interior surface from one story to the next 4. Resist lateral spread of flame from the compartment of fire origin to adjacent spaces	Passed
<b>Surface Burning Characteristics</b>	ASTM E 84	All components shall meet NFPA Class A: Flame Spread ≤ 25 Smoke Developed ≤ 450	Passed

f. Physical Properties Dow XNERGY Rigid Insulation Board

TEST	TEST METHOD	VALUE
<b>Density</b>	ASTM D 1622	24 kg/m <sup>3</sup> (1.5 lb/ft <sup>3</sup> )
<b>Thermal Resistance</b>	ASTM C 518	0.88 m <sup>2</sup> ·°C/W (5.0 °F·ft <sup>2</sup> ·h/Btu) @ 23.9 °C (75 °F)
<b>Water Absorption</b>	ASTM C 272	0.5 % by volume
<b>Compressive Strength</b>	ASTM D 1621	140 kPa (20 psi) min.
<b>Shear Strength</b>	ASTM C 273	170 kPa (25 psi)
<b>Shear Modulus</b>	ASTM C 273	2068 kPa (300 psi)
<b>Tensile Strength</b>	ASTM D 1623	340 kPa (50 psi) min.
<b>Flexural Strength</b>	ASTM C 203	276 kPa (40 psi) min.
<b>Flexural Modulus</b>	ASTM C 203	10342kPa (1500 psi)
<b>Flame Spread Index</b>	ASTM E 84	15
<b>Smoke Developed Index</b>	ASTM E 84	165
<b>Oxygen Index</b>	ASTM D2863	Min. 24%
<b>Water Vapor Permeance</b>	ASTM E96	Max. 1.5 Perm for 25.4 mm (1in) thickness

**1.05 SUBMITTALS**

- A. Product Data: The contractor shall submit to the owner/architect the manufacturer’s product data sheets describing products, which will be used on this project.
- B. Shop Drawings for Panelized Construction: The panel fabricator shall prepare and submit to the owner/architect complete drawings showing: wall layout, connections, details, expansion joints, and installation sequence.
- C. Samples: The contractor shall submit to the owner/architect two (2) samples of the Outsulation X System for each finish, texture and color to be used on the project. The same tools and techniques proposed for the actual installation shall be used. Samples shall be of sufficient size to accurately represent each color and texture being utilized on the project.
- D. Test Reports: When requested, the contractor shall submit to the owner/architect copies of selected test reports verifying the performance of the Outsulation X System.

## 1.06 QUALITY ASSURANCE

### A. Qualifications:

1. System Manufacturer: Shall be Dryvit Systems, Inc. All materials shall be obtained from Dryvit Systems, Inc. or its authorized distributors.
  - a. Materials shall be manufactured at a facility covered by a current ISO 9001:2008 and ISO 14401:2004 certification. Certification of the facility shall be done by a registrar accredited by the American National Standards Institute, Registrar Accreditation Board (ANSI-RAB).
2. Insulation Board: Shall be Dow XNERGY Rigid Insulation Board with planed surfaces.
3. Contractor: Shall be knowledgeable in the proper installation of the Dryvit Outsulation X System and shall be experienced and competent in the installation of exterior insulation and finish systems. Additionally, the contractor shall possess a current Outsulation X System trained\* contractor certificate, issued by Dryvit.

### B. Regulatory Requirements:

1. The insulation board shall be separated from the interior of the building by a minimum 15-minute thermal barrier.
2. The use and maximum thickness of insulation shall be in accordance with the applicable building codes and Dryvit requirements.

### C. Mock-Up

1. The contractor shall, before the project commences, provide the owner/architect with a mock-up for approval.
2. The mock-up shall be of suitable size as required to accurately represent each color and texture to be utilized on the project.
3. The mock-up shall be prepared with the same products, tools, equipment and techniques required for the actual applications. The finish used shall be from the same batch as that being used for the project.
4. The approved mock-up shall be available and maintained at the job site.

## 1.07 DELIVERY, STORAGE AND HANDLING

A. All Dryvit materials shall be delivered to the job site in the original, unopened packages with labels intact.

B. Upon arrival, materials shall be inspected for physical damage, freezing or overheating. Questionable materials shall not be used.

1. Materials shall be stored at the jobsite in a cool, dry location, out of direct sunlight, protected from weather and other sources of damage. Minimum storage temperature shall be as follows:
  - a. Demandit® and Revyvit®: 7 °C (45 °F)
  - b. Ameristone™, TerraNeo®, Limestone™, and Reflectit: 10 °C (50 °F)
  - c. DPR, PMR™ and E™ Finishes, Color Prime™, and Genesis®: 4 °C (40 °F)
  - d. Custom Brick™ Finish: refer to Custom Brick Polymer Specification, DS151.
  - e. For other products, refer to specific product data sheets.

2. Maximum storage temperature shall not exceed 38 °C (100 °F). **NOTE: Minimize exposure of materials to temperatures over 32 °C (90 °F). Finishes exposed to temperatures over 43 °C (110 °F) for even short periods may exhibit skinning, increased viscosity and should be inspected prior to use.**

C. Protect all products from inclement weather and direct sunlight.

## 1.08 PROJECT CONDITIONS

### A. Environmental Requirements

1. Application of materials shall not take place during inclement weather unless appropriate protection is provided. Protect materials from inclement weather until they are dry.
2. At the time of application, the minimum air and wall surface temperatures shall be as follows:
  - a. Demandit and Revyvit: 7 °C (45 °F)
  - b. Ameristone, TerraNeo, Limestone, and Reflectit: 10 °C (50 °F)
  - c. DPR, PMR and E Finishes, Color Prime, and Genesis: 4 °C (40 °F)
  - d. Custom Brick Finish: refer to Custom Brick Polymer Specification, DS151.
  - e. For other products, refer to specific product data sheets.
3. These temperatures shall be maintained with adequate air ventilation and circulation for a minimum of 24 hours (48 hours for Ameristone, TerraNeo and Limestone) thereafter, or until the products are completely dry. Refer to published product data sheets for more specific information.

B. Existing Conditions: The contractor shall have access to electric power, clean water and a clean work area at the location where the Dryvit materials are to be applied.



### **1.09 SEQUENCING AND SCHEDULING**

- A. Installation of the Outsulation X System shall be coordinated with other construction trades.
- B. Sufficient manpower and equipment shall be employed to ensure a continuous operation, free of cold joints, scaffold lines, texture variations, etc.

### **1.10 WARRANTY**

- A. Dryvit Systems, Inc. shall provide a written moisture drainage and limited materials warranty against defective material upon written request. Dryvit shall make no other warranties, expressed or implied. Dryvit does not warrant workmanship. Full details are available from Dryvit Systems, Inc.
- B. The applicator shall warrant workmanship separately. Dryvit shall not be responsible for workmanship associated with installation of the Outsulation X System.

### **1.11 DESIGN RESPONSIBILITY**

- A. It is the responsibility of both the specifier and the purchaser to determine if a product is suitable for their intended use. The designer selected by the purchaser shall be responsible for all decisions pertaining to design, detail, structural capability, attachment details, shop drawings and the like. Dryvit has prepared guidelines in the form of specifications, application details, and product sheets to facilitate the design process only. Dryvit is not liable for any errors or omissions in design, detail, structural capability, attachment details, shop drawings, or the like, whether based upon the information prepared by Dryvit or otherwise, or for any changes which purchasers, specifiers, designers, or their appointed representatives may make to Dryvit's published comments.

### **1.12 MAINTENANCE**

- A. Maintenance and repair shall follow the procedures noted in the Dryvit Outsulation X System Application Instructions, DS836.
- B. All Dryvit products are designed to require minimal maintenance. However, as with all building products, depending on location, some cleaning may be required. See Dryvit publication DS152 on Cleaning and Recoating.
- C. Sealants and Flashings shall be inspected on a regular basis and repairs made as necessary to maintain a weathertight envelope.

## **PART II PRODUCTS**

### **2.01 MANUFACTURER:**

- A. All components of the Outsulation X System shall be obtained from Dryvit or its authorized distributors. Substitutions or additions of materials other than specified will void the warranty.

### **2.02 MATERIALS**

- A. Mechanical Fasteners (3 per 2 ft x 4 ft insulation board installed while the adhesive is still wet) consist of a 51mm (2 in) diameter polypropylene washer with key openings for base coat penetration used in conjunction with a corrosion resistant fastener.
  - 1. Washer
    - a. Shall be Wind-lock Wind Devil 2 Plate.
  - 2. Screws
    - a. Wood Based Substrates and Light Gauge Metal (20 – 26 ga).
      - 1) Shall be minimum No. 6, bugle head Type S, corrosion resistant screws.
      - 2) The screws shall be of sufficient length to penetrate wood substrates a minimum of 19 mm (3/4 in), and metal framing a minimum of 9 mm (3/8 in).
    - b. Steel Framing (12 – 20 ga)
      - 1) Shall be minimum No. 6 bugle head corrosion resistant screws, drill point.
      - 2) The screws shall be of sufficient length to penetrate the steel framing a minimum of 9 mm (3/8 in).
  - 3. Brick, CMU and Concrete
    - a. Anchors shall be a minimum 4.8 mm (3/16 in) diameter and corrosion resistant.
    - b. Anchors shall be of sufficient length to penetrate the substrate a minimum of 25 mm (1 in).

- c. Pullout values shall be substantiated for the particular substrate and fastener used.
- B. Portland Cement: Shall be Type I or II, meeting ASTM C 150, white or gray in color, fresh and free of lumps.
- C. Water: Shall be clean and free of foreign matter.

**2.03 COMPONENTS**

- A. Air/Water-Resistive Barrier Components:
  - 1. Dryvit Backstop® NT: A flexible, polymer-based noncementitious water-resistive coating and air barrier available in Texture and Smooth.
  - 2. Dryvit Grid Tape™: An open weave fiberglass mesh tape with pressure sensitive adhesive available in rolls 102 mm (4 in) wide by 91 m (100 yds) long.
- B. Flashing Materials: Used to protect substrate edges at terminations.
  - 1. Liquid Applied: An extremely flexible water-based polymer material, ready for use.
    - a. Shall be AquaFlash and AquaFlash Mesh
  - 2. Sheet Type:
    - a. Shall be Flashing Tape and Surface Conditioner
      - 1) Dryvit Flashing Tape™: A high density polyethylene film backed with a rubberized asphalt adhesive available in rolls 102 mm (4 in), 152 mm (6 in) and 229 mm (9 in) wide by 23 m (75 ft) long.
      - 2) Dryvit Flashing Tape Surface Conditioner™: A water-based surface conditioner and adhesion promoter for the Dryvit Flashing Tape.
- C. Dryvit AP Adhesive™: A moisture cure, urethane-based adhesive used to adhere the Dryvit Drainage Strip.
- D. Dryvit Drainage Strip™: A corrugated plastic sheet material, which provides drainage.
- E. Adhesive: Used to adhere the insulation board to the air/water-resistive barrier: Shall be compatible with the air/water-resistive barrier and the insulation board.
  - 1. Shall be Genesis: A liquid polymer-based material, which is field mixed with Portland cement.
- F. Insulation Board: XNERGY Rigid Insulation Board manufactured by Dow Chemical USA.
  - 1. Thickness shall be 2".
  - 2. All insulation board faces shall be factory planed.
- G. Base Coat: Shall be compatible with the insulation board and reinforcing mesh(es).
  - 1. Shall be Genesis: A liquid polymer-based material, which is field mixed with Portland cement.
- H. Reinforcing Mesh
  - 1. Shall be a balanced, open weave, glass fiber fabric treated for compatibility with other system materials.

**Note: Reinforcing meshes are specified by weight as listed in the Table below:**

<b>Reinforcing Mesh/Weight</b>
<b>g/m<sup>2</sup> (oz/yd<sup>2</sup>)</b>
Panzer 20*** 695 (20.5) for 8ft

- \*\*\* Shall be used in conjunction with Standard Plus as a minimum.
- 2. Shall be colored blue for product identification and bearing the Dryvit logo.
- I. Finish: Shall be the type, color and texture as selected by the architect/owner and shall be one or more of the following:
  - 1. Standard DPR (Dirt Pickup Resistance): Water-based, acrylic coating with integral color and texture and formulated with DPR chemistry:
    - a. Sandblast DPR: Medium texture

**PART III EXECUTION**

**3.01 EXAMINATION**

- A. Prior to installation of the System, it is the Contractor’s responsibility to ensure that:
  - 1. The substrate is of a type listed in section 1.04.C.1
  - 2. The substrate is flat within 6.4 mm (1/4 in) in a 1.2 m (4 ft) radius.
  - 3. The substrate is sound, connections are tight, and there are no surface voids or projections, or other conditions that may interfere with the Outsulation X System installation.
  - 4. Metal roof flashing has been installed in accordance with Asphalt Roofing Manufacturers Association (ARMA) Standards.
  - 5. Openings are properly flashed as necessary to prevent water penetration behind the Outsulation X System and into the wall.
  - 6. Decks have been properly flashed.

**3.02 PREPARATION**

- A. The Outsulation X materials shall be protected by permanent or temporary means from inclement weather and other sources of damage prior to, during, and following application until completely dry.

- B. Protect adjoining work and property during Outsulation X installation.
- C. The substrate shall be prepared as to be free of foreign materials, such as oil, dust, dirt, form-release agents, efflorescence, paint, wax, water repellants, moisture, frost, and any other condition that may inhibit adhesion.

### **3.03 INSTALLATION**

- A. The system shall be installed in accordance with the Dryvit Outsulation X System Application Instructions, DS836.
- B. The base coat shall be applied at the recommended coverage of 11.1m<sup>2</sup> (120 sf/pail) and such that the mesh is fully embedded. The basecoat shall be applied in two (2) passes.
- C. Sealant shall not be applied directly to textured finishes or base coat surfaces. Dryvit Outsulation X System surfaces in contact with sealant shall be coated with Demandit or Color Prime.
- D. High impact meshes shall be installed as specified at ground level, high traffic areas and other areas exposed to or susceptible to impact damage.

### **3.04 FIELD QUALITY CONTROL**

- A. The contractor shall be responsible for the proper application of the Outsulation X materials.
- B. Dryvit assumes no responsibility for on-site inspections or application of its products.
- C. If required, the contractor shall certify in writing the quality of work performed relative to the substrate system, details, installation procedures, workmanship and as to the specific products used.
- D. If required, the sealant contractor shall certify in writing that the sealant application is in accordance with the sealant manufacturer's and Dryvit's recommendations.

### **3.05 CLEANING**

- A. All excess Outsulation X System materials shall be removed from the job site by the contractor in accordance with contract provisions and as required by applicable law.
- B. All surrounding areas, where the Dryvit Outsulation X System has been applied, shall be left free of debris and foreign substances resulting from the contractor's work.

### **3.06 PROTECTION**

- A. The Outsulation X System shall be protected from inclement weather and other sources of damage until dry and permanent protection in the form of flashings, sealants, etc. are installed.

END OF SECTION

SECTION 07272  
AIR BARRIER COATINGS

GENERAL

1.1 SUMMARY

- A. Section includes fluid-applied, vapor-permeable silicone air barrier assembly. **NOTE: THIS IS NOT TO BE USED IN THE DRYVIT ASSEMBLY**
- B. Related Sections:
  - 1. Section 06 16 00 "Sheathing" for air barrier coating substrate.
  - 2. Section 07 92 00 "Joint Sealants" for installation requirements for elastomeric joint sealants applied in conjunction with work of this Section.

1.2 REFERENCE STANDARDS

- A. Reference Standards, General: Applicable editions of cited reference standards are those current at time of issuing of project, or edition cited in applicable building code for project.
- B. Air Barrier Association of America (ABAA): [www.airbarrier.org](http://www.airbarrier.org)
  - 1. Training and Certification Program for Air Barrier Contractors and Installers
- C. ASTM International (ASTM): [www.astm.org](http://www.astm.org):
  - 1. ASTM C 920 – Standard Specification for Elastomeric Joint Sealants
  - 2. ASTM D 412 – Standard Test Methods for Vulcanized Rubber and Thermoplastic Elastomers-Tension
  - 3. ASTM D 624 - Standard Test Method for Tear Strength of Conventional Vulcanized Rubber and Thermoplastic Elastomers
  - 4. ASTM D 1970 - Standard Specification for Self-Adhering Polymer Modified Bituminous Sheet Materials Used as Steep Roofing Underlayment for Ice Dam Protection, Self Sealability Test
  - 5. ASTM D 4263 - Standard Test Method for Indicating Moisture in Concrete by the Plastic Sheet Method
  - 6. ASTM D 4541 - Standard Test Method for Pull-Off Strength of Coatings using Portable Adhesion Testers
  - 7. ASTM E 84 - Standard Test Method for Surface Burning Characteristics of Building Materials
  - 8. ASTM E 96 – Standard Test Methods for Water Vapor Transmission of Materials
  - 9. ASTM E 162 - Standard Test Method for Surface Flammability of Materials Using a Radiant Heat Energy Source
  - 10. 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
  - 11. ASTM E 331 - Standard Test Method for Water Penetration of Exterior Windows, Skylights, Doors, and Curtain Walls by Uniform Static Air Pressure Difference
  - 12. ASTM E 2178 - Standard Test Methods for Air Performance of Building Materials

13. ASTM E 2357 - Standard Test Method for Determining Air Leakage of Air Barrier Assemblies
14. ASTM G 154 - Standard Practice for Operating Fluorescent Ultraviolet (UV) Lamp Apparatus for Exposure of Nonmetallic Materials

D. California Department of Health Care Services (DHCS):

1. Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers

E. Federal Government Publications: [www.epa.gov/nscep](http://www.epa.gov/nscep)

1. 40 CFR 59, Subpart D-200 - National Volatile Organic Compound Emission Standards for Architectural Coatings

F. National Fire Protection Association (NFPA): [www.nfpa.org](http://www.nfpa.org)

1. NFPA 285 - Standard Fire Test Method For Evaluation Of Fire Propagation Characteristics Of Exterior Non-Load-Bearing Wall Assemblies Containing Combustible Components

G. Sealant, Waterproofing, and Restoration Institute (SWRI): [www.swrionline.org](http://www.swrionline.org):

1. SWRI Validation Program

### 1.3 ADMINISTRATIVE REQUIREMENTS

- A. Preinstallation Conference: Conduct conference at Project site. Review air barrier assembly installation requirements including substrate condition inspection, testing requirements, environmental conditions, mockups, details, and scheduling and inspection of work.

### 1.4 ACTION SUBMITTALS

- A. Product Data: For specified products, including:

1. Substrate preparation instructions and recommendations.
2. Recommended primers and accessories.
3. Standard details illustrating applications of air barrier assembly products required for Project.
4. Product test reports.

### 1.5 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For qualified applicator.
- B. Preconstruction adhesion test reports.
- C. Manufacturer's instructions for installation and field quality control testing.
- D. Field quality control adhesion test reports.
- E. Warranty: Sample of warranty.

1.6 QUALITY ASSURANCE

- A. Applicator Qualifications: Employer of experienced applicators trained by manufacturer for application of air barrier products required for this Project with record of successful completion of projects of similar scope.
- B. Mock-Up: Prior to installation of air barrier assembly, apply air barrier products [to integrated exterior wall mockup specified in Division 01 General Requirements] [to portion of wall construction designated by Architect] to verify details under product data submittals and to demonstrate tie-ins with adjoining construction, and other termination conditions, as well as application and execution specifics.
  - 1. Apply air barrier assembly to mock-up components, including back-up wall substrates, window and door frames and sills, insulation, flashing, corner condition, junctions with roof system and foundation wall, and typical penetrations and gaps, illustrating materials interfaces and seals.
  - 2. Retain mock-ups during application of the work.

1.7 DELIVERY, STORAGE AND HANDLING

- A. Deliver materials to Project site in original packaging with seals unbroken, labeled with manufacturer's name, product, date of manufacture and/or use-by date, and directions for storage.
- B. Store materials in their original undamaged packages in a clean, dry, protected location at a temperature not below 34 deg F (1 deg C) and not above 90 deg F (32 deg C).

1.8 PROJECT CONDITIONS

- A. Do not apply air barrier products during inclement weather or when such conditions are expected. Do not apply when relative humidity is greater than 90 percent or when there is a possibility of rain within 24 hours or follow manufacturer instructions.
  - 1. Allow wet substrates to dry before applying products.
- B. Do not apply air barrier products when air or substrate temperatures will be above 100 deg F (38 deg C) or below 40 deg F (5 deg C) during product drying time.

1.9 WARRANTY

- A. Special Warranty, General: Manufacturer's standard project-specific form in which manufacturer agrees to repair or replace air barrier coatings and accessory products that demonstrate deterioration or failure within warranty period specified due to material failure under normal use. Failure includes water or air penetration through air barrier assembly.
  - 1. Warranty Period: [10][15] years from date of Substantial Completion.

PRODUCTS

1.10 MANUFACTURER

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- A. Basis-of-Design Products: Provide air barrier coatings and accessory products manufactured by DOW CORNING Corp., Midland MI; (877) SEALANT, (877) 732-5268; email: [specification@dowcorning.com](mailto:specification@dowcorning.com); website: [www.dowcorning.com/construction](http://www.dowcorning.com/construction), [or comparable products of other manufacturer approved by Architect in accordance with Instructions to Bidders and Division 01 General Requirements].

### 1.11 MATERIALS, GENERAL

- A. Single Source Responsibility: Provide air barrier coatings and accessory products of a single manufacturer through a single source.
- B. VOC Content: Provide products complying with the following limits when calculated according to 40 CFR 59, Subpart D (EPA Method 24), and in accordance with VOC limitations of authorities having jurisdiction.
  - 1. Coatings: 250 g/L.
  - 2. Coating Primers: 200 g/L.
  - 3. Sealants: 250 g/L.
  - 4. Sealant Primers for Nonporous Substrates: 250 g/L.
  - 5. Sealant Primers for Porous Substrates: 775 g/L.

### 1.12 PERFORMANCE REQUIREMENTS

- A. Air Barrier Assembly, General: Provide air barrier assembly consisting of fluid-applied coating, molded transition strips, and liquid sealants that together perform as a continuous vapor-permeable air barrier, capable of accommodating normal structural movement, transitions between coating substrate materials, penetrations of coating substrates, and tie-ins to framed openings, waterproofing systems, and roofing systems, without deterioration or air leakage exceeding specified limits.
- B. Air-Barrier Assembly Air Leakage: Not more than **0.04 cfm/sq. ft. of surface area at 1.57 lbf/sq. ft. (0.2 L/s x sq. m of surface area at 75 Pa)** when tested according to ASTM E 2357.

- C. Allowable UV Exposure Time: Not less than 12 months.
- D. Surface-Burning Characteristics: Provide air barrier coatings that achieve flame-spread index of 25 or less and smoke-developed index of 450 or less per ASTM E 84.
- E. Fire Propagation Characteristics: Provide air barrier coatings and accessory materials that are tested for compliance with NFPA 285 when used as part of an exterior wall assembly identical to that required for Project.
  - 1. When testing of identical wall assembly is not available, provide engineering judgment by qualified third party testing agency acceptable to authorities having jurisdiction demonstrating equivalent compliance with requirements.

1.13 SILICONE AIR BARRIER ASSEMBLY

- A. Air Barrier Coatings: Fluid-applied, water-based, vapor-permeable, one-component silicone elastomeric coating.
  - 1. Product: **DOW CORNING Corp., DefendAir 200 Silicone Liquid-Applied Air and Weather Barrier.**
  - 2. Air Permeance, ASTM E 2178: Not more than **0.004 cfm/sq. ft. of surface area at 1.57- lbf/sq. ft. (0.02 L/s x sq. m of surface area at 75-Pa).**
  - 3. Vapor Permeance, ASTM E 96, Method B: Not less than 20 perms.
  - 4. Ultimate Elongation, ASTM D 412: Not less than 600 percent.
  - 5. UV Exposure and Resistance, ASTM G 154: Not less than 5,000 hour exposure.
- B. Silicone Elastomer Weather Barrier Transition Strips: Highly-flexible clear flashing and transition sheet with pre-molded corner accessory pieces for bonding to weather barrier substrates and to adjacent curtain wall, storefront, and window frames and other transition substrates using silicone sealant.
  - 1. Product: **DOW CORNING Corp., Silicone Transition System (STS).**
  - 2. Air Infiltration, ASTM E 283: Maximum **0.025 cfm/sq. ft. (0.127 L/s per sq. m) at 6.24 lbf/sq. ft. (300 Pa).**
  - 3. Water Penetration under Static Pressure, ASTM E 331: None at **15 lbf/sq. ft. (720 Pa).**
  - 4. Movement Capability: Not less than plus 200, minus 75 percent.
  - 5. Tensile Strength, ASTM D 412: Not less than **800 psi (5.5 MPa).**
  - 6. Tear Strength, ASTM D 624: Not less than **200 psi (16 kN/m).**
  - 7. Elongation, ASTM D 412: Not less than 400 percent.
  - 8. Hardness, ASTM D 412: 50 - 60 durometer Shore A.
- C. Silicone Elastomer Seals: Highly flexible low-modulus flashing and transition material for bonding to substrates with silicone sealant. SWRI validated.
  - 1. Product: **DOW CORNING Corp., 123 Silicone Seal.**
  - 2. Bonding Sealant: Manufacturer's recommended neutral-curing silicone.
  - 3. Hardness, ASTM D 2240: 25 durometer Shore A, minimum.
- D. Detail Joint and Bonding Sealant: ASTM C 920, single-component, neutral-curing silicone, Grade NS, SWRI-validated, of Class indicated, compatible with adjacent materials. Provide products recommended by air barrier manufacturer for application.
  - 1. Class 25: Product: **DOW CORNING Corp., 758 Silicone Weatherbarrier Sealant.**
  - 2. Class 50: Product: **DOW CORNING Corp., 791 Silicone Weatherproofing Sealant.**



3. Class 50: Product: **DOW CORNING Corp., 795 Silicone Building Sealant.**
4. Class 50: Product: **DOW CORNING Corp., 756 SMS.**

#### 1.14 ACCESSORY MATERIALS

- A. Crack Fillers: Substrate manufacturer's recommended crack fillers or sealants compatible with air barrier assembly components and adjacent materials.
- B. Primer: Air barrier coating manufacturer's recommended, factory-formulated, alkali-resistant primer compatible with substrate and adjacent materials.

### EXECUTION

#### 1.15 EXAMINATION

- A. Examine substrates to determine if work is ready to receive air barrier system. Verify that surfaces are clean, dry, and free of frost, dust, dirt, grease, oil, curing compounds, form release agents, laitance, efflorescence, mildew, excess alkalinity, and other conditions affecting performance of work.
  1. Verify that new concrete and mortar to receive coating application has cured adequately in accordance with substrate and air barrier coating manufacturers' instructions.
- B. Preinstallation Testing: Prior to application of air barrier coatings, perform the following tests to verify condition of substrate in accordance with manufacturer's instructions:
  1. Adhesion: Perform substrate field adhesion tests on each substrate to determine if primer is required to satisfactorily adhere air barrier coatings to substrates.
  2. Alkalinity: Verify substrate is within alkalinity range acceptable to manufacturer.
  3. Moisture Level: Verify substrate moisture content is acceptable to manufacturer. Verify substrate is visibly dry and free of moisture.
- C. Proceed with air barrier coating work once conditions meet air barrier coating manufacturer's recommendations.

#### 1.16 PREPARATION

- A. General: Comply with air barrier coating manufacturer's written instructions for preparation of substrates. Protect work of other trades against damage from application of air barrier coatings.
- B. Cleaning: Clean substrates to remove contaminants and foreign material by pressure cleaning, wire brushing, grinding or other method recommended by air barrier coatings manufacturer.
- C. Substrate Repair: Repair deteriorated or damaged substrates, repair masonry joints, and fill cracks, voids, honeycomb, and other defects using materials as recommended in writing by air barrier coating manufacturer. Allow patching materials to cure.
  1. Fill cracks larger than **1/16 inch (1.6 mm)** wide using joint sealant listed in Part 2. Fill cracks larger than **1 inch (25 mm)** wide using joint sealant and compatible bond breaker where movement is expected.

- D. Protection: Protect adjacent surfaces not designated to receive air barrier coatings. Provide protection for pedestrians, vehicles, landscaping, and surrounding areas to prevent contact with coating materials.
- E. Primer: Apply primer to substrates where required based upon preinstallation testing and air barrier coating manufacturer's recommendations, using application methods and rate of application recommended by manufacturer. Allow to dry prior to application of air barrier coating.

#### 1.17 AIR BARRIER APPLICATION

- A. Transition Strips and Elastomer Seals: Install with approved sealants in accordance with manufacturer's written instructions.
  - 1. Form tie-in to window, storefront, and curtain wall frames, door frames, louver frames, roofing system perimeters, and at interface of other adjacent materials utilizing compatible accessory materials forming part of air barrier assembly.
  - 2. Promptly adhere laps and bonds to substrates.
- B. Air Barrier Coating: Apply air barrier coating using application methods and rate of application recommended by manufacturer. Apply using nap roller or airless sprayer, as allowed by authorities having jurisdiction.
  - 1. Provide wet application of not less than **0.030 inch (0.76 mm)** thickness or more as required by substrate conditions in order to provide finished dry film thickness of not less than **0.015 inch (0.38 mm)**.
  - 2. Apply additional coats when required to provide uniform, continuous cured airtight and watertight film.

#### 1.18 FIELD QUALITY CONTROL

- A. Owner may retain testing agency to perform the following tests:
  - 1. Verification that substrate preparation meets requirements.
  - 2. Testing and certification that coating materials comply with requirements for thickness and continuity.
  - 3. Testing of application for compliance with adhesion and film thickness requirements.
- B. If testing indicates products or work do not meet requirements, Owner may stop work and require Contractor to remove non-complying materials and materials applied over non-complying substrates, and otherwise correct application.

#### 1.19 CLEANING AND PROTECTION

- A. Curing and Protection: Allow air barrier coatings to cure before exposure to traffic or other construction operations. Prevent damage to coatings resulting from construction operations or other causes. Replace damaged air barrier coatings prior to concealment behind subsequent construction.
- B. Cleaning: Remove overspray and excess material as work progresses, using materials and methods approved by manufacturer that will not damage adjacent materials.
- C. Remove temporary coverings and protection upon completion. Clean and repair adjacent

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surfaces damaged by air barrier coating application.  
END OF SECTION

**SECTION 07500  
PVC ROOFING AND FLASHING**

**PART 1 GENERAL**

1.01 DESCRIPTION OF WORK

A. Fully adhered PVC sheet roofing, tapered and flat roof insulation, elastomeric flashing, wood nailers, tapered edge strips, roof drains and plumbing.

1.02 CODES, REGULATIONS AND STANDARDS

A. Contractor Responsibility: The Contractor shall assume full responsibility and liability for compliance with all applicable Federal, State and local codes, regulations and standards pertaining to work practices, hauling, disposal, protection of workers and visitors to the site, and persons occupying areas adjacent to the site. This includes modification of procedures to comply with changes to codes, regulations and standards which occur during the work of this contract. The Contractor is responsible for providing medical examinations and maintaining medical records of personnel as required by the applicable Federal, State and local regulations. The Contractor shall hold the Owner and Owner's Representatives harmless for failure to comply with any applicable work, hauling, disposal, safety, health or other regulations on the part of himself, his employees or his subcontractors.

1.03 QUALITY ASSURANCE

A. Roofing contractor to be approved in writing by the membrane manufacturer. Contractor shall be able to substantiate that he has been trained by the membrane manufacturer.

B. Roofing and flashing workmanship to comply with industry standards. The National Roofing Contractors Association's (NRCA) **ROOFING AND WATERPROOFING MANUAL** along with **ARCHITECTURAL SHEET METAL MANUAL** as published by Sheet Metal and Air Conditioning Contractors National Association, Inc. (SMACNA) will be used to establish industry standards.

1.04 SUBMITTALS

A. Sample twenty (20) year watertight warranty for the PVC membrane.

**Warranty shall include wind speeds up to 72 miles per hour. The standard 55 MPH is not acceptable for this job.**

B. Manufacturer's details of the proposed fascia system along with standard color chart.

C. Sample twenty (20) year material warranty for the PVC membrane.

1.05 PRODUCT DELIVERY, STORAGE AND HANDLING

A. Deliver materials in their original, unopened containers, clearly labeled with manufacturer's name. All material to be stored in waterproof trailers or sheds, up on raised platforms and under lock and key until use. Do not use materials damaged in handling or storage. Replace damaged material with new material. Store adhesives between 60 and 80 degrees F. Should they be exposed to lower temperatures, restore to room temperature for three to five days prior to use.

1.06 WARRANTY

A. A twenty (20) year watertight warranty and twenty (20) year material warranty shall be issued by the PVC membrane manufacturer. **Warranty shall include wind speed up to 72 MPH.**

B. The roofing contractor shall furnish the Owner with his personal two (2) year watertight warranty.

## PART 2 PRODUCTS

### 2.01 ROOF INSULATION

A. Tapered roof insulation to be polyisocyanurate closed-cell foam core with manufacturer's standard facing laminated to both sides, complying with FS HH-I-1972/2, Class 1. Use 1/4" per foot tapered isocyanurate as per the tapered layout. The minimum thickness at the drains to be 4.0" and will taper at the rate of 1/4" per foot to a maximum thickness of 12.0". Use 1/2" per foot tapered isocyanurate to form crickets between the drains.

B. Over all foam insulation, install one layer of 7/16" APA rated oriented strand board (OSB).

C. Tapered edge strips to be 1-1/2" by 18" fiberboard. Use tapered edge strips at the drains to create an additional sump for the drains.

### 2.02 MEMBRANE ROOF SYSTEM

A. Membrane roofing to be fully adhered, 0.060", gray, reinforced, PVC sheet roofing by Carlisle, Sarnafil, Duro-Last or approved equal. Roof membrane to be fully adhered to the 7/16" OSB.

B. Use the PVC membrane for flashing of curbs and walls per the manufacturer's standard details.

C. Adhesives, sealants, thinner, cleaner and accessories to be furnished by the membrane manufacturer.

### 2.03 ROOF DRAINS AND PLUMBING

A. New overflow roof drains shall be Zurn Z 164 furnished with cast iron domes and "Top-Set" deck plates.

### 2.04 METAL FLASHING

A. Edge strip to be formed using a PVC coated 24 gauge, G90 galvanized steel. Concealed clips to be formed using 24 gauge G90 galvanized steel.

### 2.05 WOOD NAILERS AND BLOCKING

A. All wood nailers and blocking shall be #2 or better kiln dried spruce, fir or pine. Plywood to be exterior type.

### 2.06 FASTENERS

A. Use annular-ring hot dipped galvanized nails to secure the new edge strip.

B. Use fasteners recommended by the membrane manufacturer to secure anchor bars and termination bars.

C. Wood nailers to be secured using annular-ring hot dipped galvanized nails, galvanized dry-wall screws, #14-10 Heavy Duty Roofing Fasteners, carriage bolts or expansion anchors.

D. Fasteners used to secure roof insulation to the steel deck to be #14-10 Heavy Duty Roofing Fasteners with CR-10 coating, a minimum shank diameter of 0.170" and a thread diameter of 0.125". Pressure plates to be 3" diameter Galvalume plates. Screws and plates to be manufactured by Olympic Fasteners or approved equal. Length, size and accessories to be as required by the PVC membrane manufacturer selected.

### **PART 3 EXECUTION**

#### **3.01 PREPARATION OF SURFACES**

A. Surfaces on which the roofing system is to be applied shall be clean, smooth, dry, free of fins, rot, sharp edges, loose and foreign materials, oil and grease.

#### **3.02 ROOF INSULATION**

A. Insulation shall be tightly butted with joints not more than 1/8" in width. Stagger joints with those in layer below. OSB to be installed with a 1/16"-1/8" gap at all joints.

B. Fasten insulation to the roof deck with the appropriate screws and plates. Fastener quantity and layout must meet the requirements of the PVC manufacturer to obtain their 72 MPH wind speed warranty.

C. Stagger joints in one direction for each course. For multiple layers, stagger joints in both directions between courses leaving no gaps, allowing a complete thermal envelope to be formed.

D. Provide tapered units to suit drainage pattern indicated.

E. Do not install more insulation in a day than can be covered with membrane before end of day or before start of inclement weather.

#### **3.03 ROOF MEMBRANE**

A. Adhere PVC membrane to the 7/16" OSB in strict accordance with the manufacturer's specifications.

#### **3.04 FLASHING - - WALLS, PARAPETS, CURBS AND VENTS**

A. Use the longest pieces of material which are practical. All flashing and terminations shall be done in accordance with the applicable manufacturer's details.

B. Install termination bars at the top of all base flashing, fastening a minimum of 6" on center.

#### **3.05 EDGE STRIPS**

A. Bottom edge of PVC clad edge strips to be secured with continuous cleats.

#### **3.06 ROOF DRAINS AND PLUMBING**

A. Install new roof drains in accordance with the manufacturer's instructions. Review installation procedure with job-site inspector prior to installing drains.

#### **3.07 WOOD NAILERS AND BLOCKING**

A. Securely fasten new wood nailers to structural members so as to resist a force of 200 pounds per lineal foot in any direction.

#### **3.08 TEMPORARY WATER CUT-OFF**

A. Temporary water cut-offs are to be constructed at the end of each working day to protect the insulation, roofing, building and building interior from damage due to wind, snow and rain.

B. Temporary water cut-offs are to be detailed by the contractor and approved by the manufacturer and Owner.

### 3.09 CLEAN UP

A. Site clean-up shall be complete and to the satisfaction of the Owner.

B. All roofs, building, landscape and parking areas shall be cleaned of all trash, debris and dirt caused by or associated with this work.

C. Any areas stained, dirtied, discolored or otherwise damaged due to this work shall be cleaned, restored and replaced as required.

D. All debris shall be removed from the premises promptly and the construction area left clean daily.

### 3.10 INSPECTION AND TESTING

THE OWNER RESERVES THE RIGHT TO INSPECT AND TEST ALL CONSTRUCTION OPERATIONS AND MATERIALS.

A. Any defect or noncompliance discovered by inspection shall be reported to the contractor who shall promptly remove any defective material from the site.

B. The Owner reserves the right to inspect the work or parts of it as he chooses. His failure to inspect the work in progress shall not relieve the contractor of the responsibility for properly executing the contracted work, nor shall it impair the Owner's right to reject deficiencies he may subsequently discover.

## **PART 4 JOB CONDITIONS**

A. Roofing to be applied in dry weather.

B. Completed roof areas shall not be trafficked. The work shall be coordinated to prevent this situation by working toward the roof edges.

C. This project is subject to compliance with all requirements of the Occupational Safety and Health Administration (OSHA). All work on this project must meet the requirements of all applicable state and local codes, laws and ordinances.

END OF SECTION

SECTION 07815

SPRAYED CEMENTITIOUS FIREPROOFING

PART 1 - GENERAL

- 1.0 DESCRIPTION OF WORK: Spray fireproofing of steel structure (columns and beams and as indicated on drawings) to provide required amount of protection, in hours, based upon the Building Codes described on the Cover Sheet and within the construction documents. Work to include, but is not limited to:
- a. The protection of exposed steel members

1.01 SECTION INCLUDES

- A. Cementitious three (3) hour spray-on fireproofing of structural steel with clean up of all areas affected by the work of this section.

1.02 RELATED WORK SPECIFIED ELSEWHERE

- A. Fire Stopping: Section 07840

1.03 REFERENCES:

- A. ASTM E 84 - Surface Burning Characteristics
- B. ASTM E 119 - Standard Methods of Fire Tests of Building Construction and Materials
- C. ASTM E 136 - Behavior of Materials in a Vertical Tube Furnace at 750°C
- D. ASTM E 736 - Cohesion/Adhesion of Sprayed Fire-Resistive Materials Applied to Structural Members.
- E. ASTM E 761 - Test Method for Compressive Strength of Sprayed Fire-Resistive Materials Applied to Structural Members
- F. ASTM E 859 - Air Erosion of Sprayed Fire-Resistive Materials Applied to Structural Members
- G. ASTM E 937 - Corrosion Resistance
- H. UBC Standard 7-6 - "Thickness and Density Determination for Spray-Applied Fireproofing"
- I. UL - "Fire Resistance Directory"

1.04 QUALITY ASSURANCE

- A. The applicator shall be licensed (or otherwise approved) by the manufacturer of the fireproofing materials and have 3 years experience in spraying fireproofing on similar projects.
- B. Products, execution and fireproofing material thickness and density shall conform to the applicable IBC 2003, UL "Fire Resistance Directory" and UL test reports or to this specification, which ever is more stringent.

1.05 SUBMITTALS

- A. Submit manufacturer's product literature, test reports, and application instructions for each fireproofing material to be used. All test reports shall be representative of current application standards. All test reports shall indicate all materials not in the original fireproofing bags to be



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added by the applicator. The test report shall indicate concentration and quantity added for the specimens prepared.

- B. After manufacturer approval and prior to application, submit table showing the thickness, density and UL Design Number to be used for each condition. Submit any laboratory test reports used in this table not included in the current UL Fire Resistance Directory.
- C. LEED Submittals: Complete the LEED Materials Documentation Sheet and provide manufacturers' product data for construction adhesives and sealants, including printed statement of VOC content and MSDS Sheets.

### 1.06 PRODUCT DELIVERY, STORAGE, AND HANDLING

- A. Deliver fireproofing material in manufacturer's original, unopened packaging, clearly identified with manufacturer's name, brand, batch number and UL label.
- B. Store materials above ground in a dry location, protected from the weather. Discard and remove from jobsite all materials exposed to moisture or otherwise damaged or deteriorated.

### 1.07 PROJECT CONDITIONS

- A. Maintain temperature of substrate and ambient air at 40 degrees F minimum for 24 hours before, during and after application of fireproofing. If required, use heaters to maintain minimum temperatures.
- B. Provide natural or mechanical ventilation to allow proper curing and drying of the sprayed material during and after its application.

### 1.08 MOCK-UP

- A. Install the proposed materials to an area not less than one bay, demonstrating typical conditions present on the project.
- B. Comply with project requirements as to thickness and density. Testing lab to measure density of mockup.
- C. The mock-up area shall be inspected by the architect prior to proceeding with the work of this section. The mock-up area shall not be disturbed or covered until the completion of the work, unless ordered by the architect.
- D. All work of this section shall be in accordance with the approved mock-up.

### 1.09 WARRANTY

- A. Provide warranty that fireproofing will remain free of cracking, dusting, flaking and loss of bond for a period of 2 years and that failed areas will be repaired to the satisfaction of the owner at no additional cost.

## PART 2 - MATERIALS

### 2.01 ACCEPTABLE MANUFACTURERS: Products which meet the performance required in this specification:

- A. A.W.R Grace or Equal.
  - 1. 1<sup>st</sup> floor beams, columns and bracing , Monokote Z-106/HY Medium Density, three (3) hour rating.

2.02 MATERIALS

A. Install materials with the following performance characteristics:

	Standard (15# Density)
Minimum Individual and Average Density (unless higher in the UL Fire Resistance Directory)	15 pcf
Compressive Strength ASTM E-761	1,200 psf
Bond Strength ASTM E736	200 psf

2. Flame Spread of "0" per ASTM E-84;
3. Classified as to fire resistance in accordance with the designs in the UL "Fire Resistance Directory" using ASTM E-119;
4. Non-combustible per ASTM E-136
5. Maximum allowable weight loss shall be 0.005 grams/sq. ft. when tested under ASTM E-859;
6. Fireproofing shall not promote corrosion when measured by ASTM E-937. Testing shall evaluate "as applied" conditions including any accelerators added at the mixer or nozzle.

B. Fireproofing materials shall contain no asbestos and be formulated to be applied with a wet-slurry, not sprayed fibers with water added at the application site.

C. Water shall be potable and free of substances which would adversely affect fireproofing materials.

PART 3 - EXECUTION

3.01 PREPARATION

- A. Clean substrates of rust, mill scale, paint, primers, dirt, dust, grease, oil and other substances which may affect the bond strength.
- B. Painted or primed steel members shall be treated following the requirements in the UL Fire Resistance Directory.

3.03 INSTALLATION

- A. Coordinate installation of fireproofing with other Work in order to minimize the need to cut or remove fireproofing.

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- B. Mix and apply fireproofing materials in accordance with manufacturer's printed instructions and fire-resistive ratings specified. Apply to all areas requiring fireproofing, as shown on the Drawings. Thickness and density, as measured by UBC Standard 7-6, to comply with the specifications and UL "Fire Resistance Directory".
- C. Protect fireproofing until permanent cover is installed, or until completion where exposed to view in the completed Work.

### 3.04 FIELD QUALITY CONTROL

- A. As the work progresses, the Testing Agency shall perform thickness and density testing using UBC Standard 7-6. The results of that testing shall be made available to contractor and architect at the completion of each Test Area. The Testing Agency shall perform bond tests, if required, using ASTM E 736.

### 3.05 CLEANING

- A. After completion of each day's work, remove overspray materials and clean exposed surfaces to remove evidence of soiling by fireproofing materials.

END OF SECTION

**SECTION 07840  
FIRESTOPPING**

**PART 1 - GENERAL**

1.01 RELATED DOCUMENTS

- A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division-1 Specification Section, apply to work specified in this section.

1.02 DEFINITIONS

- A. Firestopping: Material or combination of materials used to retain integrity of fire-rated construction by maintaining an effective barrier against the spread of flame, smoke, and hot gases through penetrations in, or construction joints between, fire rated wall and floor assemblies.

1.03 GENERAL DESCRIPTION OF THE WORK OF THIS SECTION

Only tested firestop systems shall be used in specific locations as follows:

- A. Penetrations for the passage of duct, cable, cable tray, conduit, piping, electrical busways and raceways through fire-rated vertical barriers (walls and partitions), horizontal barriers (floor/ceiling assemblies), and vertical service shaft walls and partitions.
- B. Safing slot gaps between edge of floor slabs and curtain walls.
- C. Openings between structurally separate sections of wall or floors.
- D. Gaps between the top of walls and ceilings or roof assemblies.
- E. Expansion joints in walls and floors.
- F. Openings and penetrations in fire-rated partitions or walls containing fire doors.
- G. Openings around structural members which penetrate floors or walls.

1.04 RELATED WORK OF OTHER SECTIONS

- A. Coordinate work of this section with work of other sections as required to properly execute the work and as necessary to maintain satisfactory progress of the work of other sections, including:
  - 1. Section 03 30 00 - Cast-In-Place Concrete
  - 2. Section 04 20 00 - Unit Masonry
  - 3. Section 07 90 00 - Joint Sealants
  - 4. Section 09 20 00 - Plaster and Gypsum Board
  - 5. Section 13 48 00 - Sound, Vibration and Seismic Control
  - 6. Section 21 00 00 - Fire Suppression
  - 7. Section 22 00 00 - Plumbing
  - 8. Section 23 00 00 - Heating, Ventilating, and Air Conditioning (HVAC)
  - 9. Section 26 00 00 - Electrical
  - 10. Section 26 00 00 – Communications

## 1.05 REFERENCES

- A. Test Requirements: ASTM E 814, "Standard Method of Fire Tests of Through Penetration Fire Stops"
- B. Test Requirements: UL 1479, "Fire Tests of Through-Penetration Firestops"
- C. Test Requirements: UL 2079, "Tests for Fire Resistance of Building Joint Systems"
- D. Underwriters Laboratories (UL) of Northbrook, IL publishes tested systems in their "FIRE RESISTANCE DIRECTORY" that is updated annually.
  - 1. UL Fire Resistance Directory:
    - a. Firestop Devices (XHJI)
    - b. Fire Resistance Ratings (BXRH)
    - c. Through-Penetration Firestop Systems (XHEZ)
    - d. Fill, Voids, or Cavity Material (XHHW)
    - e. Forming Materials (XHKU)
    - f. Joint Systems (XHBN)
    - g. Perimeter Fire Containment Systems (XHDG)
  - 2. Alternate Systems: "Omega Point Laboratories Directory" (updated annually).
- E. Test Requirements: ASTM E 1966, "Standard Test Method for Fire Resistive Joint Systems"
- F. Test Requirements: ASTM E 2307, "Standard Test Method for Determining Fire Resistance of Perimeter Fire Barrier Systems Using Intermediate-Scale, Multi-story Test Apparatus"
- G. Inspection Requirements: ASTM E 2174, "Standard Practice for On-site Inspection of Installed Fire Stops"
- H. ASTM E 84, "Standard Test Method for Surface Burning Characteristics of Building Materials"
- I. International Firestop Council Guidelines for Evaluating Firestop Systems Engineering Judgments
- J. International Building Code (IBC 2009)
- K. NFPA 101 - Life Safety Code
- L. NFPA 70 - National Electric Code

## 1.06 QUALITY ASSURANCE

- A. Fire-Test-Response Characteristics: Provide through-penetration fire stop systems and fire-resistive joint systems that comply with specified requirements of tested systems.
- B. Fire stop System installation must meet requirements of ASTM E 814, UL 1479 or UL 2079 tested assemblies that provide a fire rating equal to that of construction being penetrated.
- C. Proposed fire stop materials and methods shall conform to applicable governing codes having local jurisdiction.

- D. Fire stop Systems do not reestablish the structural integrity of load bearing partitions/assemblies, or support live loads and traffic. Installer shall consult the structural engineer prior to penetrating any load bearing assembly.
- E. For those firestop applications that exist for which no qualified tested system is available through a manufacturer, an engineering judgment derived from similar qualified tested system designs or other tests will be submitted to local authorities having jurisdiction for their review and approval prior to installation. Engineering judgment documents must follow requirements set forth by the International Firestop Council.

#### 1.07 SUBMITTALS

- A. Submit Product Data: Manufacturer's specifications and technical data for each material including the composition and limitations, documentation of qualified tested firestop systems to be used and manufacturer's installation instructions to comply with Section 01 30 00.
- B. Manufacturer's engineering judgment identification number and document details when no qualified tested system is available for an application. Engineering judgment must include both project name and contractor's name who will install firestop system as described in document.
- C. Submit material safety data sheets provided with product delivered to job-site.

#### 1.08 INSTALLER QUALIFICATIONS

- A. Engage an experienced Installer who is certified, licensed, or otherwise qualified by the firestopping manufacturer as having been provided the necessary training to install manufacturer's products per specified requirements. A supplier's willingness to sell its firestopping products to the Contractor or to an Installer engaged by the Contractor does not in itself confer qualification on the buyer.
- B. Installation Responsibility: assign installation of through-penetration firestop systems and fire-resistive joint systems in Project to a single sole source firestop specialty contractor.
  - NOTE: THE REQUIREMENT FOR A SINGLE SOLE SOURCE FIRESTOP SPECIALTY CONTRACTOR IS A CONDITION OF THE BUILDING PERMIT FROM THE CITY OF PORTLAND AND IS NOT NEGOTIABLE. FIRESTOPPING CANNOT BE INSTALLED ON A TRADE-BY-TRADE BASIS.
- C. The work is to be installed by a contractor with at least one of the following qualifications:
  - FM 4991 Approved Contractor
  - UL Approved Contractor
  - Hilti Accredited Fire Stop Specialty Contractor

#### 1.09 DELIVERY, STORAGE, AND HANDLING

- A. Deliver materials undamaged in manufacturer's clearly labeled, unopened containers, identified with brand, type, and UL label where applicable.
- B. Coordinate delivery of materials with scheduled installation date to allow minimum storage time at job-site.

- C. Store materials under cover and protect from weather and damage in compliance with manufacturer's requirements, including temperature restrictions.
- D. Comply with recommended procedures, precautions or remedies described in material safety data sheets as applicable.
- E. Do not use damaged or expired materials.

1.10 PROJECT CONDITIONS

- A. Do not use materials that contain flammable solvents.
- B. Schedule installation of firestopping after completion of penetrating item installation but prior to covering or concealing of openings.
- C. Verify existing conditions and substrates before starting work. Correct unsatisfactory conditions before proceeding.
- D. Weather conditions: Do not proceed with installation of firestop materials when temperatures exceed the manufacturer's recommended limitations for installation printed on product label and product data sheet.
- E. During installation, provide masking and drop cloths to prevent firestopping materials from contaminating any adjacent surfaces.

**PART 2 - PRODUCTS**

2.01 FIRESTOPPING - GENERAL

- A. Provide firestopping composed of components that are compatible with each other, the substrates forming openings, and the items, if any, penetrating the firestopping under conditions of service and application, as demonstrated by the firestopping manufacturer based on testing and field experience.
- B. Provide components for each firestopping system that are needed to install fill material. Use only components specified by the firestopping manufacturer and approved by the qualified testing agency for the designated fire-resistance-rated systems.
- C. Penetrations in Fire Resistance Rated Walls: Provide firestopping with ratings determined in accordance with UL 1479 or ASTM E 814.
  - 1. F-Rating: Not less than the fire-resistance rating of the wall construction being penetrated.
- D. Penetrations in Horizontal Assemblies: Provide firestopping with ratings determined in accordance with UL 1479 or ASTM E 814.
  - 1. F-Rating: Minimum of 1-hour rating, but not less than the fire-resistance rating of the floor construction being penetrated.
  - 2. T-Rating: when penetrant is located outside of a wall cavity, minimum of 1-hour rating, but not less than the fire-resistance rating of the floor construction being penetrated.
  - 3. W-Rating: Class 1 rating in accordance with water leakage test per UL 1479.

- E. Penetrations in Smoke Barriers: Provide firestopping with ratings determined in accordance with UL 1479 or ASTM E 814.
  - 1. L-Rating: Not exceeding 5.0 cfm/sq. ft. of penetration opening at both ambient and elevated temperatures.
- F. Mold Resistance: Provide penetration firestopping with mold and mildew resistance rating of 0 as determined by ASTM G21.
- G. Firestopping Materials are either “cast-in-place” (integral with concrete placement) or “post installed.” Provide cast-in-place firestop devices prior to concrete placement.

## 2.02 ACCEPTABLE MANUFACTURERS

- A. Subject to compliance with through penetration firestop systems (XHEZ), joint systems (XHBN), and perimeter firestop systems (XH DG) listed in Volume 2 of the UL Fire Resistance Directory; provide products of the following manufacturers as identified below:
  - 1. Hilti, Inc., Tulsa, Oklahoma  
800-879-8000  
[www.us.hilti.com](http://www.us.hilti.com)  
Chris Allington 508-509-8316  
Chris.allington@hilti.com
  - 2. Substitution requests shall be considered in accordance with contract provisions.

## 2.03 MATERIALS

- A. Use only firestop products that have been UL 1479, ASTM E 814 or UL 2079 tested for specific fire-rated construction conditions conforming to construction assembly type, penetrating item type, annular space requirements, and fire-rating involved for each separate instance.
- B. Pre-installed firestop devices for use with noncombustible and combustible pipes (closed and open systems), conduit, and/or cable bundles penetrating concrete floors and/or gypsum walls, the following products are acceptable:
  - 1. Hilti Cast-In Place Firestop Device (CP 680-P)
    - a. Add Aerator Adaptor when used in conjunction with aerator system.
  - 2. Hilti Tub Box Kit (CP 681) for use with tub installations.
  - 3. Hilti Cast-In Place Firestop Device (CP 680-M) for use with noncombustible penetrants.
  - 4. Hilti Speed Sleeve (CP 653) for use with cable penetrations.
  - 5. Hilti Firestop Drop-In Device (CFS-DID) for use with noncombustible and combustible penetrants.
  - 6. Hilti Firestop Block (CFS-BL)
- C. Sealants, caulking materials, or foams for use with non-combustible items including steel pipe, copper pipe, rigid steel conduit and electrical metallic tubing (EMT), the following products are acceptable:
  - 1. Hilti Intumescent Firestop Sealant (FS-ONE)
  - 2. Hilti Self-leveling Firestop Sealant (CP 604)
  - 3. Hilti Fire Foam (CP 620)
  - 4. Hilti Flexible Firestop Sealant (CP 606)
  - 5. Hilti Elastomeric Firestop Sealant (CP 601S)



- D. Sealants or caulking materials for use with sheet metal ducts, the following products are acceptable:
  - 1. Hilti Elastomeric Firestop Sealant (CP 601S)
  - 2. Hilti Flexible Firestop Sealant (CP 606)
  - 3. Hilti Intumescent Firestop Sealant (FS-ONE)
  
- E. Sealants, caulking or spray materials for use with fire-rated construction joints and other gaps, the following products are acceptable:
  - 1. Hilti Firestop Joint Spray (CFS-SP WB)
  - 2. Hilti Elastomeric Firestop Sealant (CP 601S)
  - 3. Hilti Flexible Firestop Sealant (CP 606)
  - 4. Hilti Self-leveling Firestop Sealant (CP 604)
  
- F. Pre-formed mineral wool designed to fit flutes of metal profile deck and gap between top of wall and metal profile deck; as a backer for spray material.
  - 1. Hilti Speed Plugs (CP 777)
  - 2. Hilti Speed Strips (CP 767)
  
- G. Intumescent sealants, caulking materials for use with combustible items (penetrants consumed by high heat and flame) including insulated metal pipe, PVC jacketed, flexible cable or cable bundles and plastic pipe, the following products are acceptable:
  - 1. Hilti Intumescent Firestop Sealant (FS-ONE)
  
- H. Foams, intumescent sealants, or caulking materials for use with flexible cable or cable bundles, the following products are acceptable:
  - 1. Hilti Intumescent Firestop Sealant (FS-ONE)
  - 2. Hilti Fire Foam (CP 620)
  - 3. Hilti Elastomeric Firestop Sealant (CP 601S)
  - 4. Hilti Flexible Firestop Sealant (CP 606)
  
- I. Non-curing, re-penetrable intumescent putty or foam materials for use with flexible cable or cable bundles, the following products are acceptable:
  - 1. Hilti Firestop Putty Stick (CP 618)
  - 2. Hilti Firestop Plug (CFS-PL)
  
- J. Wall opening protective materials for use with U.L. listed metallic and specified nonmetallic outlet boxes, the following products are acceptable:
  - 1. Hilti Firestop Putty Pad (CP 617)
  - 2. Hilti Firestop Box Insert
  
- K. Firestop collar or wrap devices attached to assembly around combustible plastic pipe (closed and open piping systems), the following products are acceptable:
  - 1. Hilti Firestop Collar (CP 643N)
  - 2. Hilti Firestop Collar (CP 644)
  - 3. Hilti Wrap Strips (CP 648E/648S)

- L. Materials used for large openings and complex penetrations made to accommodate cable trays and bundles, multiple steel and copper pipes, electrical busways in raceways, the following products are acceptable:
  - 1. Hilti Firestop Mortar (CP 637)
  - 2. Hilti Firestop Block (CFS-BL)
  - 3. Hilti Fire Foam (CP 620)
  - 4. Hilti Firestop Board (CP 675T)
  
- M. Non curing, re-penetrable materials used for large size/complex penetrations made to accommodate cable trays and bundles, multiple steel and copper pipes, electrical busways in raceways, the following products are acceptable:
  - 1. Hilti Firestop Block (CFS-BL)
  - 2. Hilti Firestop Board (CP 675T)
  
- N. Sealants or caulking materials used for openings between structurally separate sections of wall and floors, the following products are acceptable:
  - 1. Hilti Firestop Joint Spray (CFS-SP WB)
  - 2. Hilti Elastomeric Firestop Sealant (CP 601S)
  - 3. Hilti Flexible Firestop Sealant (CP 606)
  - 4. Hilti Self-leveling Firestop Sealant (CP 604)
  
- O. For blank openings made in fire-rated wall or floor assemblies, where future penetration of pipes, conduits, or cables is expected, the following products are acceptable:
  - 1. Hilti CFS-BL Firestop Block
  - 2. Hilti CFS-PL Firestop Plug
  
- P. Provide a firestop system with a "F" Rating as determined by UL 1479 or ASTM E814 which is equal to the time rating of construction being penetrated.
  
- Q. Provide a firestop system with an Assembly Rating as determined by UL 2079 which is equal to the time rating of construction joint assembly.

### **PART 3 - EXECUTION**

#### **3.01 PREPARATION**

- A. Verification of Conditions: Examine areas and conditions under which work is to be performed and identify conditions detrimental to proper or timely completion.
  - 1. Verify penetrations are properly sized and in suitable condition for application of materials.
  - 2. Surfaces to which firestop materials will be applied shall be free of dirt, grease, oil, rust, laitance, release agents, water repellents, and any other substances that may affect proper adhesion.
  - 3. Provide masking and temporary covering to prevent soiling of adjacent surfaces by firestopping materials.
  - 4. Comply with manufacturer's recommendations for temperature and humidity conditions before, during and after installation of firestopping.
  - 5. Do not proceed until unsatisfactory conditions have been corrected.

3.02 COORDINATION

- A. Coordinate construction of openings, penetrations and construction joints to ensure that the fire stop systems are installed according to specified requirements.
- B. Coordinate sizing of sleeves, openings, core-drilled holes, or cut openings to accommodate through-penetration fire stop systems. Coordinate construction and sizing of joints to ensure that fire-resistive joint systems are installed according to specified requirements.
- C. Coordinate fire stopping with other trades so that obstructions are not placed in the way prior to the installation of the fire stop systems.
- D. Do not cover up through-penetration fire stop and joint system installations that will become Concealed behind other construction until each installation has been examined by the building inspector.

3.03 INSTALLATION

- A. Regulatory Requirements: Install firestop materials in accordance with UL Fire Resistance Directory or Omega Point Laboratories Directory.
- B. Manufacturer's Instructions: Comply with manufacturer's instructions for installation of through-penetration and construction joint materials.
  - 1. Seal all holes or voids made by penetrations to ensure an air and water resistant seal.
  - 2. Consult with mechanical engineer, project manager, and damper manufacturer prior to installation of UL firestop systems that might hamper the performance of fire dampers as it pertains to duct work.
  - 3. Protect materials from damage on surfaces subjected to traffic.

3.04 FIELD QUALITY CONTROL

- A. Examine sealed penetration areas to ensure proper installation before concealing or enclosing areas.
- B. Keep areas of work accessible until inspection by applicable code authorities.
- C. Inspection of through-penetration firestopping shall be performed in accordance with ASTM E 2174, "Standard Practice for On-Site Inspection of Installed Fire Stops" or other recognized standard.
- D. Perform under this section patching and repairing of firestopping caused by cutting or penetrating of existing firestop systems already installed by other trades.
- E. Manufacturer's Field Services: During Installation, provide periodic destructive testing inspections to assure proper installation/application. After installation is complete, submit findings in writing indicating whether or not the installation of the tested system identified was installed correctly.

3.05 IDENTIFICATION & DOCUMENTATION

- A. The firestop contractor is to supply documentation for each single application addressed. This documentation is to identify each penetration and joint location on the entire project.
- A.1 The Documentation Form for through penetrations is to include:
  - 1. A Sequential Location Number
  - 2. The Project Name
  - 3. Date of Installation
  - 4. Detailed description of the penetrations location
  - 5. Tested System or Engineered Judgment Number
  - 6. Type of assembly penetrated
  - 7. A detailed description of the size and type of penetrating item
  - 8. Size of opening
  - 9. Number of sides of assemblies addressed
  - 10. Hourly rating to be achieved
  - 11. Installers Name
- A.2 The Documentation Form for Construction Joints is to include:
  - 1. A Sequential Location Number
  - 2. The Project Name
  - 3. Date of Installation
  - 4. Detailed description of the Construction Joints location
  - 5. Tested System or Engineered Judgment Number
  - 6. Type of Construction Joint
  - 7. The Width of the Joint
  - 8. The Lineal Footage of the Joint
  - 9. Number of sides addressed
  - 10. Hourly rating to be achieved
  - 11. Installers Name
- B. Copies of these documents are to be provided to the general contractor at the completion of the project.
- C. Identify through-penetration firestop systems with pressure-sensitive, self-adhesive, preprinted vinyl labels. Attach labels permanently to surfaces of penetrated construction on both sides of each firestop system installation where labels will be visible to anyone seeking to remove penetrating items or firestop systems. Include the following information on labels:
  - 1. The words: "Warning -Through Penetration Firestop System-Do Not Disturb. Notify Building Management of Any Damage."
  - 2. Contractor's Name, address, and phone number.
  - 3. Through-Penetration firestop system designation of applicable testing and inspecting agency.
  - 4. Date of Installation.
  - 5. Through-Penetration firestop system manufacturer's name.
  - 6. Installer's Name.

### 3.06 ADJUSTING AND CLEANING

- A. Remove equipment, materials and debris, leaving area in undamaged, clean condition.
- B. Clean all surfaces adjacent to sealed holes and joints to be free of excess firestop materials and soiling as work progresses.

**3.07 LABOR USE TO INSTALL FIRESTOP SYSTEMS**

- A. To ensure complete harmony on the project site, the installation of each scope of work is to be performed jurisdictionally correct per existing trade agreements.

**END OF SECTION**

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Sealants are referenced to Section 07900, Sealants Sealers.

Glass and glazing are referenced in Section 08810, Glass and Glazing.

### PART 1 - GENERAL

#### 1.01 SUMMARY

- A. Related Documents: Conditions of the Contract, Division 1 - General Requirements, and Drawings apply to Work of this Section.
- B. Section Includes:
  - 1. Storefront system, complete with reinforcing, fasteners, anchors, and attachment devices.
  - 2. Accessories necessary to complete work.
- C. Products Furnished But Not Installed Under This Section:
  - 1. Anchoring devices that are built into masonry.
  - 2. Anchoring devices that are cast in concrete.

#### 1.02 REFERENCES

- A. Aluminum Association (AA):
  - 1. DAF-45 Designation System for Aluminum Finishes.
- B. American Architectural Manufacturers Association (AAMA):
  - 1. 501 Methods of Test for Exterior Walls.
  - 2. 501.2 Quality Assurance and Diagnostic Water Leakage Field Check of Installed Storefronts, Curtain Walls, and Sloped Glazing Systems.
  - 3. 2605 Voluntary Specification, Performance Requirements and Test Procedures for Superior Performing Organic Coatings on Aluminum Extrusions and Panels.
  - 4. 611 Voluntary Specification for Anodized Architectural Aluminum.
  - 5. 701 Voluntary Specifications for Pile Weatherstripping and Replaceable Fenestration Weatherseals.
  - 6. 1503 Voluntary Test Method for Thermal Transmittance and Condensation Resistance of Windows, Doors, and Glazed Wall Sections.
  - 7. 1801 Voluntary Specification for the Acoustical Rating of Windows, Doors, and Glazed Wall Sections.
  - 8. CW-10 Care and Handling of Architectural Aluminum From Shop to Site.
  - 9. SFM1 Aluminum Storefront and Entrance Manual.
- C. American Society for Testing and Materials (ASTM):
  - 1. A36 Structural Steel.
  - 2. A123 Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products.
  - 3. B209 Aluminum and Aluminum - Alloy Sheet and Plate.
  - 4. B221 Aluminum-Alloy Extruded Bars, Rods, Wire, Shapes, and Tubes.
  - 5. E283 Test Method for Rate of Air Leakage Through Exterior Windows, Curtain Walls and Doors.
  - 6. E330 Test Method for Structural Performance of Exterior Windows, Curtain Walls and Doors by Uniform Static Air Pressure Difference.
  - 7. E331 Test Method for Water Penetration of Exterior Windows, Curtain Walls and Doors by Uniform Static Air Pressure Difference.
- D. Glass Association of North America (GANA):
  - 1. Glazing Manual
- E. Federal Specifications (FS):
  - 1. TT-P-641G(1) Primer Coating, Zinc Dust-Zinc Oxide (For Galvanized Surfaces).
  - 2. TT-P-645A Primer, Paint, Zinc Chromate, Alkyd Type.

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- F. Steel Structures Painting Council (SSPC):
1. Cold-Applied Asphalt Mastic (Extra Thick Film).

### 1.03 SYSTEM REQUIREMENTS

A. Design Requirements:

1. Drawings are diagrammatic and do not purport to identify nor solve problems of thermal or structural movement, glazing, anchorage, or moisture disposal.
2. Requirements shown by details are intended to establish basic dimension of units, sight lines and profiles of members.
3. Provide concealed fastening.
4. Provide entrance and storefront systems, including necessary modifications, to meet specified requirements and maintaining visual design concepts.
5. Attachment considerations are to take into account site peculiarities and expansion and contraction movements so there is no possibility of loosening, weakening or fracturing connection between units and building structure or between units themselves.
6. Provide for expansion and contraction due to structural movement without detriment to appearance or performance.
7. Framing systems shall accommodate expansion and contraction movement due to surface temperature differentials of 180 degrees F without causing buckling, stress on glass, failure of joint seals, excessive stress on structural elements, reduction of performance, or other detrimental effects.

B. Performance Requirements:

1. Wind loads: Provide framing system capable of withstanding wind load design pressures of [ ] psf acting inward and [ ] psf acting outward. The design pressures are based on the [ ] Building Code; [ ] Edition.
2. Air infiltration: Air leakage through fixed light areas of storefront shall not exceed 0.06 cfm per square foot of surface area when tested in accordance with ASTM E283 at differential static pressure of 6.24 psf.
3. Water infiltration: No uncontrolled leakage when tested in accordance with ASTM E331 at test pressure of 10 psf as defined in AAMA 501.
4. Deflection:  
Maximum calculated deflection of any framing member in direction normal to plane of wall when subjected to specified design pressures for spans up to and including 13'-6" shall be limited to [1/175] of its clear span and for spans greater than 13'-6" deflection shall be limited to [1/240] of its clear span + 1/4", except that maximum deflection of members supporting plaster surfaces shall not exceed 1/360 of its span.
5. Thermal Transmittance (U-factor): When tested to AAMA Specification 1503, the thermal transmittance (U-factor) shall not be more than:
  - a. Glass to Exterior – 0.54 (clear)
  - b. Glass to Center – 0.63 (clear)
  - c. Glass to Interior – 0.51 (clear)
6. Condensation Resistance (CRF): When tested to AAMA Specification 1503, the condensation resistance factor shall not be less than:
  - a. Glass to Exterior – 69 frame and 60 glass (clear)
  - b. Glass to Center – 58 frame and 61 glass (clear)
  - c. Glass to Interior – 57 frame and 57 glass (clear)
7. Sound Transmission Class (STC): When tested to AAMA Specification 1801, the STC Rating shall not be less than:
  - a. Glass to Exterior – 38 (laminated)
  - b. Glass to Center – 37 (laminated)

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- c. Glass to Interior – 38 (laminated)

### 1.04 SUBMITTALS

- A. General: Submit in accordance with Section 01300.
  - B. Product Data:
    - 1. Submit manufacturer's descriptive literature and product specifications.
    - 2. Include information for factory finishes, hardware, accessories, and other required components.
    - [3. Include color charts for finish indicating manufacturer's standard colors available for selection.]
  - C. Shop Drawings:
    - 1. Submit shop drawings covering fabrication, installation and finish of specified systems.
    - 2. Include following:
      - a. Fully dimensioned plans and elevations with detail coordination keys.
      - b. Locations of exposed fasteners and joints.
    - 3. Provide detailed drawings of:
      - a. Composite members.
      - b. Joint connections for framing systems and for entrance doors.
      - c. Anchorage.
      - d. System reinforcements.
      - e. System expansion and contraction provisions.
      - f. Glazing methods and accessories.
      - g. Internal sealant requirements.
      - h. Thermal improvements.
    - 4. Schedule of finishes.
  - D. Samples:
    - 1. Submit manufacturer's standard samples indicating quality of finish.
    - 2. Where normal texture or color variations are expected, include additional samples illustrating range of variation.
    - [3. Submit samples for each type of glass, 12 x 12 inch size.]
  - E. Test Reports:
    - 1. Standard Systems: Submit certified copies of previous test reports substantiating performance of system in lieu of retesting. Include other supportive data as necessary.
  - F. Qualification Data:
    - 1. Submit installer qualifications verifying years of experience.
- Manufacturer's Instructions: Submit manufacturer's printed installation instructions.

- 1. To ensure quality of appearance and performance, obtain materials for systems from either a single manufacturer or from manufacturer approved by systems manufacturer.

- B. Installer Qualifications: Certified in writing by system manufacturer as qualified for installation of specified systems.
- C. Perform Work in accordance with AAMA SFM1 and manufacturer's written instructions.

### 1.06 DELIVERY, STORAGE, AND HANDLING

- A. Comply with requirements of Section 01600.
- B. Protect finished surfaces as necessary to prevent damage.
- C. Do not use adhesive papers or sprayed coatings that become firmly bonded when exposed to sun.
- D. Do not leave coating residue on any surfaces.
- E. Replace damaged units.

### 1.07 WARRANTY

- A. Provide warranties in accordance with Section 01700.
- B. Provide written warranty in form acceptable to Owner jointly signed by manufacturer, installer and Contractor warranting work to be watertight, free from defective materials, defective workmanship, glass breakage due to defective design, and agreeing to replace components which fail within 1 year from date



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of Substantial Completion.

C. Warranty shall cover following:

- 1. Complete watertight and airtight system installation within specified tolerances.
- 2. System is structurally sound and free from distortion.

\*\*\*\*\*

Delete paragraph below if high performance fluoropolymer finish not used.

\*\*\*\*\*

- D. Provide written warranty stating organic coating finish will be free from fading more than 10%, chalking, yellowing, peeling, cracking, pitting, corroding or non-uniformity of color, or gloss deterioration beyond manufacturer's descriptive standards for 1 year from date of Substantial Completion and agreeing to promptly correct defects.

**PART 2 - PRODUCTS**

**2.01 MANUFACTURERS AND PRODUCTS**

- A. Subject to compliance with requirements indicated, provide products by one of the following:
  - 1. Oldcastle BuildingEnvelope®, Terrell, TX.
- B. Substitutions: Submit under provisions of Section 01630, a minimum of 10 days prior to bid date.

C. Acceptable Storefront Framing System:

Series 6000 Thermal MultiPlane, glass set to the front, , thermally broken, [exterior, or interior] loaded 2" x 6" mullion profile. This system uses a poured-in-place polyurethane thermal pocket to create its thermal break. This system accommodates 1" glass thickness.

**2.02 FRAMING MATERIALS AND ACCESSORIES**

A. Aluminum:

- 1. ASTM B221, alloy 6063-T5 for extrusions; ASTM B209, alloy 5005-H16 for sheets; or other alloys and temper recommended by manufacturer appropriate for specified finish.

B. Internal Reinforcing:

- 1. ASTM A36 for carbon steel.
- 2. Shapes and sizes to suit installation.
- 3. Steel components factory coated with alkyl type zinc chromate primer complying with FS TT-P-645.

C. Anchorage Devices:

- 1. Manufacturer's standard formed or fabricated steel or aluminum assemblies of shapes, plates, bars or tubes.
- 2. Hot-dip galvanize steel assemblies after fabrication; comply with ASTM A123, 2.0 ounce minimum coating.

D. Fasteners:

- 1. Aluminum, non-magnetic stainless steel or other non-corrosive materials compatible with items being fastened.
- 2. Provide concealed fasteners wherever possible.
- 3. For exposed locations, provide Phillips flathead screws with finish matching item fastened.
- 4. For concealed locations, provide manufacturer's standard fasteners.

E. Expansion Anchor Devices: Lead-shield or toothed-steel, drilled-in, expansion bolt anchors.

F. Protective Coatings: Cold-applied asphalt mastic complying with SSPC, compounded for 30 mil thickness for each coat; or alkyl type zinc chromate primer complying with FS TT-P-645.

G. Touch-Up Primer for Galvanized Components: Zinc oxide conforming with FS TT-P-641.

H. Glazing Gas kets:

- 1. Compression type design, replaceable, molded or extruded, of neoprene, polyvinyl chloride (PVC), or ethylene propylene diene monomer (EPDM).

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- 2. Profile and hardness as required to maintain uniform pressure for watertight seal.
- I. Weatherstripping:
  - 1. Wool pile conforming to AAMA 701.2.
  - 2. Provide EPDM or vinylblade gasket weatherstripping in bottom door rail, adjustable for contact with threshold.
- J. Internal Sealants and Baffles.

**2.03 GLASS AND GLAZING ACCESSORIES**

- A. Refer to Section 08810.

**2.04 FABRICATION**

- A. Coordination of Fabrication:
  - 1. Check actual frame or door openings required in construction work by accurate field measurements before fabrication.
  - 2. Fabricate units to withstand loads that will be applied when system is in place.
- B. General
  - 1. Conceal fasteners wherever possible.
  - 2. Reinforce work as necessary for performance requirements, and for support to structure.
  - 3. Separate dissimilar metals and aluminum in contact with concrete utilizing protective coating or preformed separators, which will prevent contact and corrosion.
  - 4. Comply with Section 08810 for glazing requirements.
- C. Aluminum Framing:
  - 1. Provide members of size, shape and profile indicated, designed to provide for glazing from [exterior] [interior].
  - 2. Provide manufacturer's standard thermal break between exterior and interior aluminum surfaces.
  - 3. Fabricate frame assemblies with joints straight and tight fitting.
  - 4. Reinforce internally with structural members as necessary to support design loads.
  - 5. Maintain accurate relation of planes and angles, with hairline fit of contacting members.
  - 6. Seal horizontals and direct moisture accumulation to exterior.
  - 7. Provide flashings and other materials used internally or externally that are corrosive resistant, non-staining, non-bleeding and compatible with adjoining materials.
  - 8. Provide manufacturer's extrusions and accessories to accommodate expansion and contraction due to temperature changes without detrimental to appearance or performance.
- D. Welding:
  - 1. Comply with recommendations of the American Welding Society.
  - 2. Use recommended electrodes and methods to avoid distortion and discoloration.
  - 3. Grind exposed welds smooth and flush with adjacent surfaces; restore mechanical finish.
- E. Flashings: Form from sheet aluminum with same finish as extruded sections. Apply finish after fabrication. Material thickness as required to suit condition without deflection or "oil-canning".

\*\*\*\*\*  
Select and edit following items for appropriate finish; delete inapplicable types. Oldcastle Building Envelope® is a licensed applicator for all of the coating manufacturers listed below.  
\*\*\*\*\*

**2.05 FINISHES**

- 1. Manufacturer's standard colors as selected by Architect.

available.

\*\*\*\*\*

- [B. Clear Anodized:
  - 1. Con forming to AA-M12C22 A31 and AAMA 611.
  - 2. Architectural Class II, etched, medium matte, clear anodic coating, 0.4 mil minimum thickness.]

\*\*\*\* OR \*\*\*\*

- [C. Color Anodized:
  - 1. Con forming to AA-M12C22 A44 and AAMA 611.
  - 2. Architectural Class [I][II], etched, medium matte, [black] [dark bronze] [medium bronze] [light bronze] colored anodic coating, [0.7] [0.4] mil minimum thickness.]

PART 3 - EXECUTION

3.01 EXAMINATION

- A. Examine conditions and proceed with Work in accordance with Section 01400.

3.02 INSTALLATION

- A. Erection Tolerances:
  - 1. Limit variations from plumb and level:
    - a. 1/8 inch in 10'-0" vertically.
    - b. 1/8 inch in 20'-0" horizontally.
  - 2. Limit variations from theoretical locations: 1/4 inch for any member at any location.
  - 3. Limit offsets in theoretical end-to-end and edge-to-edge alignment: 1/16 inch from flush surfaces not more than 2 inches apart or out-of-flush by more than 1/4 inch.
- B. Install doors and hardware in accordance with manufacturer's printed instructions.
- C. Set units plumb, level and true to line, without warp or rack of frame.
- D. Anchor securely in place, allowing for required movement, including expansion and contraction.
- E. Separate dissimilar materials at contact points, including metal in contact with masonry or concrete surfaces, with bituminous paint or preformed separators to prevent contact and corrosion.
- F. Set sill members in bed of sealant. Set other members with internal sealants and baffles to provide weather-tight construction.
- G. Coordinate installation of perimeter sealant and backing materials between assemblies and adjacent construction in accordance with requirements of Section 07920.
- H. Glazing: Refer to requirements of Section 08810.

3.03 ADJUSTING

- A. Test door operating functions. Adjust closing and latching speeds and other hardware in accordance with manufacturer's instructions to ensure smooth operation.

3.04 CLEANING

- A. Clean surfaces in compliance with manufacturer's recommendations; remove excess mastic, mastic smears, foreign materials and other unsightly marks.
- B. Clean metal surfaces exercising care to avoid damage.

END OF SECTION

**STEEL DOORS AND FRAMES**

**SECTION 08100**

PART 1 – GENERAL

1.01 GENERAL PROVISIONS:

- A. The CONDITIONS OF THE CONTRACT and all Sections of Division 1 are hereby made a part of this section.

1.02 DESCRIPTION OF WORK:

- A. Work Included: Provide labor, materials, and equipment necessary to complete the work of this section. Extent of steel doors and frames required is indicated on drawings and in schedules.

- 1. Furnish and Install:

- a. Steel frames for hollow metal doors
    - b. Steel frames for wood doors
    - c. Steel sidelite, borrowed lite, and transom frames
    - d. Hollow metal doors

- 2. Install Only: Finish hardware for hollow metal doors as specified in Section 08710 Finish Hardware.

- B. Related work specified elsewhere:

- 1. SECTION 08210: WOOD DOORS
  - 2. SECTION 08710: FINISH HARDWARE
  - 3. SECTION 09900: PAINTING

1.03 QUALITY ASSURANCE; SUBMITTALS:

- A. General: Comply with requirements of SECTION 01300 - SUBMITTALS, MEETINGS & RECORD DOCUMENTS and SECTION 01400 - QUALITY CONTROL SERVICES.

- B. Manufacturer: Provide steel doors and frames complying with these specifications from one of the following:

- 1. CECO
  - 2. Curries
  - 3. Steelcraft

- C. Supplier: A recognized hollow metal supplier, with in-house fabrication facilities, who has been furnishing doors and frames in the project's vicinity for a period of not less than five years.
- D. Product Data: Submit four copies of manufacturers technical product data for each item. Include whatever information may be necessary to show compliance with requirements, and include instructions for installation and maintenance.
- E. Door Schedule: Submit final door schedule in manufacturer's standard format and as outlined below. Coordinate doors, frames and related work to ensure proper size, thickness, hand, function, and fasteners.
  - 1. **NOTE: Contractor shall make all submittals for finish hardware, doors, frames and related items simultaneously, only after proper review and coordination by own staff beforehand.**
  - 2. Final Door Schedule Content: Based on doors and frames in drawings, organize door schedule to indicate complete designations of every item required for each door or opening. Include the following information:
    - a. Type, style, hand, size and construction of each item.
    - b. Anchors and fastenings to related work.
    - c. Corner construction of welded and/or knocked down frames.
    - d. Location of door and frame cross-referenced to indications on drawings both on floor plans and in hardware schedule.
    - e. Explanation of all abbreviations, symbols, codes, etc. contained in schedule.
    - f. Mounting locations for hardware.
    - g. Door construction and materials.
    - h. Gage and finish of all materials.
  - 3. Shop Drawings: Submit separate detail drawings, referenced to door schedule, showing size, hand, construction, fasteners, anchors and all other details pertinent to the fabrication of doors and frames for this project.

1.04 APPROVAL OF SUBSTITUTIONS:

- A. Manufacturers and model numbers specified herein are to establish a standard of quality. If products other than those specifically identified herein are to be considered for this Project, they must be submitted for approval of the Architect not less than ten (10) calendar days prior to receipt of General Bids.
- B. Requests for approval of substitutions shall be in writing, accompanied by catalog cuts, technical information and physical samples.
- C. Approval of substitutions shall only be valid when issued by Architect to all bidders in the form of Addendum.

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### 1.05 REFERENCES:

- A. ANSI A115 Series: Standards for Steel Doors And Frames.
- B. NFPA 80, NFPA 101.
- C. Other applicable building and life safety codes.
- D. Door and Hardware Institute: "Recommended Locations for Builder's Hardware.
- E. ANSI A117.1: American National Standard Providing Accessibility and Usability for Physically Handicapped People.
- F. Other applicable industry standards.

### 1.06 PRODUCT PACKAGING AND HANDLING:

- A. Tag each item or package separately, with identification related to final door schedule.
- B. All doors shall be packaged in full cartons and securely banded.
- C. Doors and frames shall be received by the contractor at the jobsite and handled in a manner so as not to be damaged. They shall be stored upright in a protected area on wood runners or skids and shall be covered with vented tarpaulins or plastic.

### 1.07 WARRANTY: Doors and frames specified for this Project shall be guaranteed against defects in material and workmanship for a period of one (1) year from date of Substantial Completion of Project.

## PART 2 - PRODUCTS

### 2.01 MATERIALS:

- A. Doors shall be manufactured from commercial quality cold-rolled steel sheets. Exterior doors shall be A60 hot-dipped galvanized.
- B. Frames shall be manufactured from commercial quality cold-rolled steel sheets. Exterior frames shall be A60 hot-dipped galvanized.
- C. Steel shall conform to ASTM standards A366 or A620 and A568 (uncoated), ASTM A526 or A642 and A525 (galvanized).
- D. All doors and frames shall be chemically treated for paint adhesion and prime painted to meet performance requirements of ANSI A224.1.

### 2.02 DOOR FABRICATION:

- A. Interior doors shall be 1-3/4" thick, manufactured from two 18 gage steel sheets. A one piece resin-impregnated honeycomb core with sanded edges shall be securely bonded to both face sheets. Doors shall have mechanically interlocked vertical edges, flush face sheets, and hairline seam edges. The top and bottom of the door shall be closed flush by 16 gage steel channels (where concealed door bottoms are specified, bottom channel shall be

reversed to allow insertion of door bottom into door web). At contractor option, in lieu of honeycomb cores, doors may be provided with a rigid polystyrene foam core, continuously bonded to the face sheets, and completely filling the door.

- B. Exterior doors shall be 1-3/4" thick, manufactured from two 16 gage galvanized steel sheets. The interior of the doors shall be completely filled with a foamed-in-place polyurethane core, chemically bonded to all interior surfaces. Doors shall have mechanically interlocked vertical edges, flush face sheets, and hairline seam edges. The top and bottom of the door shall be closed flush by 16 gage steel channels (where concealed door bottoms are specified, bottom channel shall be reversed to allow insertion of door bottom into door web).
- C. All doors shall be handed type with factory preparation for all concealed or mortised Finish Hardware scheduled. Door closer reinforcements shall be provided for all doors whether scheduled to received closer or not. Reinforce doors for all surface applied hardware.
- D. Non-handed doors, and/or filler plates for cutouts not required for scheduled hardware preparation shall NOT be acceptable.

2.03 FRAME FABRICATION:

- A. General: Frames shall be knocked down and field assembled or welded type at contractor option.
- B. Standard knockdown or welded frames shall be manufactured form 16 gage steel sheets with 2" face and 5/8" integral stop. Jamb depth to be determined by wall thickness in accordance with the drawings. Supply appropriate anchors for wall construction.
- C. Drywall frames shall be manufactured form 16 gage steel sheets with 2" face and 5/8" integral stop and double back bend to grip the partition firmly without marring the wall surface. Jamb depth to be determined by wall thickness in accordance with the drawings. Provide adjustable plumb anchors to insure square and plumb installation. Supply standard floor anchors for bottom of each jamb.
- D. Prepare frames for all concealed or mortised hardware and reinforce for all surface applied hardware.
- E. Provide plaster guards for all hardware cutouts.
- F. Prepare frames to receive pneumatic type silencers: two for each pair frame, three for each single frame.
- G. Exterior frames shall be 16 ga welded, galvanized with thermally broken jambs.

2.04 FIRE RATED ASSEMBLIES

- A. All labeled fire doors and frames shall be of a type tested in accordance with ANSI/UL-10b, ASTM E-152, NFPA-252, or UL-305, and shall provide the degree of fire protection, heat transmission, panic-loading capabilities, and/or smoke control as indicated on the label and required by the drawings.

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- B. Labeled doors and frames shall bear the label of Underwriters Laboratories, Warnock Hersey, or Factory Mutual and shall meet all requirements of the labeling agencies current procedures and policies.

**PART 3 - EXECUTION**

**3.01 INSTALLATION**

- A. Doors and frames shall be assembled, installed, and erected plumb and in true alignment and in conformance with manufacturer's recommendations and final approved shop drawings. Preparation for surface applied hardware shall be performed on the jobsite. Frames shall be rigid and securely anchored in place. Doors shall be installed in a manner to achieve functional operation and appearance.
- B. Install hardware in compliance with 08710 FINISH HARDWARE.

END OF SECTION



SECTION 08411  
ALUMINUM WINDOWS  
(SERIES 3 000 THERMAL MULTIPLANE)

PART 1 - GENERAL

1.01 SUMMARY

- A. Related Documents: Conditions of the Contract, Division 1 - General Requirements, and Drawings apply to Work of this Section.
- B. Section Includes:
  - 1. Storefront system, complete with reinforcing, fasteners, anchors, and attachment devices.
  - 2. Accessories necessary to complete work.
- C. Products Furnished But Not Installed Under This Section:
  - 1. Anchoring devices that are built into masonry.
  - 2. Anchoring devices that are cast in concrete.

1.02 REFERENCES

- A. Aluminum Association (AA):
  - 1. DAF-45 Designation System for Aluminum Finishes.
- B. American Architectural Manufacturers Association (AAMA):
  - 1. 501 Methods of Test for Exterior Walls.
  - 2. 501.2 Quality Assurance and Diagnostic Water Leakage Field Check of Installed Storefronts, Curtain Walls, and Sloped Glazing Systems.
  - 3. 2605 Voluntary Specification, Performance Requirements and Test Procedures for Superior Performing Organic Coatings on Aluminum Extrusions and Panels.
  - 4. 611 Voluntary Specification for Anodized Architectural Aluminum.
  - 5. 701 Voluntary Specifications for Pile Weatherstripping and Replaceable Fenestration Weatherseals.
  - 6. 1503 Voluntary Test Method for Thermal Transmittance and Condensation Resistance of Windows, Doors, and Glazed Wall Sections.
  - 7. 1801 Voluntary Specification for the Acoustical Rating of Windows, Doors, and Glazed Wall Sections.
  - 8. CW-10 Care and Handling of Architectural Aluminum From Shop to Site.
  - 9. SFM1 Aluminum Storefront and Entrance Manual.
- C. American Society for Testing and Materials (ASTM):
  - 1. A36 Structural Steel.
  - 2. A123 Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products.
  - 3. B209 Aluminum and Aluminum - Alloy Sheet and Plate.
  - 4. B221 Aluminum-Alloy Extruded Bars, Rods, Wire, Shapes, and Tubes.
  - 5. E283 Test Method for Rate of Air Leakage Through Exterior Windows, Curtain Walls and Doors.
  - 6. E330 Test Method for Structural Performance of Exterior Windows, Curtain Walls and Doors by Uniform Static Air Pressure Difference.
  - 7. E331 Test Method for Water Penetration of Exterior Windows, Curtain Walls and Doors by Uniform Static Air Pressure Difference.
- D. Glass Association of North America (GANA):
  - 1. Glazing Manual
- E. Federal Specifications (FS):
  - 1. TT-P-641G(1) Primer Coating, Zinc Dust-Zinc Oxide (For Galvanized Surfaces).
  - 2. TT-P-645A Primer, Paint, Zinc Chromate, Alkyd Type.
- F. Steel Structures Painting Council (SSPC):
  - 1. Cold-Applied Asphalt Mastic (Extra Thick Film).

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### 1.03 SYSTEM REQUIREMENTS

#### A. Design Requirements:

1. Drawings are diagrammatic and do not purport to identify nor solve problems of thermal or structural movement, glazing, anchorage, or moisture disposal.
2. Requirements shown by details are intended to establish basic dimension of units, sight lines and profiles of members.
3. Provide concealed fastening.
4. Provide entrance and storefront systems, including necessary modifications, to meet specified requirements and maintaining visual design concepts.
5. Attachment considerations are to take into account site peculiarities and expansion and contraction movements so there is no possibility of loosening, weakening or fracturing connection between units and building structure or between units themselves.
6. Provide for expansion and contraction due to structural movement without detriment to appearance or performance.
7. Framing systems shall accommodate expansion and contraction movement due to surface temperature differentials of 180 degrees F without causing buckling, stress on glass, failure of joint seals, excessive stress on structural elements, reduction of performance, or other detrimental effects.
8. Stresses placed on structural silicone sealants shall be kept within sealant manufacturer's recommended maximum.]

#### B. Performance Requirements: See Attachment

1. Air infiltration: Air leakage through fixed light areas of storefront shall not exceed 0.06 cfm per square foot of surface area when tested in accordance with ASTM E283 at differential static pressure of 6.24 psf.
2. Water infiltration: No uncontrolled leakage when tested in accordance with ASTM E331 at test pressure of 10 psf as defined in AAMA 501.
3. Deflection:  
Maximum calculated deflection of any framing member in direction normal to plane of wall when subjected to specified design pressures for spans up to and including 13'-6" shall be limited to [1/175] of its clear span and for spans greater than 13'-6" deflection shall be limited to [1/240] of its clear span + 1/4", except that maximum deflection of members supporting plaster surfaces shall not exceed 1/360 of its span.
4. Thermal Transmittance (U-factor): When tested to AAMA Specification 1503, the thermal transmittance (U-factor) shall not be more than:
  - a. Glass to Exterior – 0.54 (clear)
  - b. Glass to Center – 0.56 (clear)
  - c. Glass to Interior – 0.51 (clear)
5. Condensation Resistance (CRF): When tested to AAMA Specification 1503, the condensation resistance factor shall not be less than:
  - a. Glass to Exterior – 69 frame and 60 glass (clear)
  - b. Glass to Center – 58 frame and 54 glass (clear)
  - c. Glass to Interior – 57 frame and 57 glass (clear)
6. Sound Transmission Class (STC): When tested to AAMA Specification 1801, the STC Rating shall not be less than:
  - a. Glass to Exterior – 38 (laminated)
  - b. Glass to Center – 37 (laminated)
  - c. Glass to Interior – 38 (laminated)

#### C. Testing Requirements: Provide components that have been previously tested by an independent testing laboratory.

### 1.04 SUBMITTALS

#### A. General: Submit in accordance with Section 01300.

#### B. Product Data:

1. Submit manufacturer's descriptive literature and product specifications.
2. Include information for factory finishes, hardware, accessories, and other required components.
3. Include color charts for finish indicating manufacturer's standard colors available for selection.]

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- C. Shop Drawings:
    - 1. Submit shop drawings covering fabrication, installation and finish of specified systems.
    - 2. Include following:
      - a. Fully dimensioned plans and elevations with detail coordination keys.
      - b. Locations of exposed fasteners and joints.
    - 3. Provide detailed drawings of:
      - a. Composite members.
      - b. Joint connections for framing systems and for entrance doors.
      - c. Anchorage.
      - d. System reinforcements.
      - e. System expansion and contraction provisions.
      - f. Glazing methods and accessories.
      - g. Internal sealant requirements.
      - h. Thermal improvements.
    - 4. Schedule of finishes.
  - D. Samples:
    - 1. Submit manufacturers standard samples indicating quality of finish.
    - 2. Where normal texture or color variations are expected, include additional samples illustrating range of variation.
    - [3. Submit samples for each type of glass, 12 x 12 inch size.]
  - E. Test Reports:
    - 1. Standard Systems: Submit certified copies of previous test reports substantiating performance of system in lieu of retesting. Include other supportive data as necessary.
  - F. Qualification Data:
    - 1. Submit installer qualifications verifying years of experience.
- Manufacturer's Instructions: Submit manufacturer's printed installation instructions.

### 1.05 QUALITY ASSURANCE

- A. Single Source Responsibility:
  - 1. To ensure quality of appearance and performance, obtain materials for systems from either a single manufacturer or from manufacturer approved by systems manufacturer.
- B. Installer Qualifications: Certified in writing by system manufacturer as qualified for installation of specified systems.
- C. Perform Work in accordance with AAMA SFM1 and manufacturer's written instructions.

### 1.06 DELIVERY, STORAGE, AND HANDLING

- A. Comply with requirements of Section 01600.
- B. Protect finished surfaces as necessary to prevent damage.
- C. Do not use adhesive papers or sprayed coatings that become firmly bonded when exposed to sun.
- D. Do not leave coating residue on any surfaces.
- E. Replace damaged units.

### 1.07 WARRANTY

- A. Provide warranties in accordance with Section 01700.
- B. Provide written warranty in form acceptable to Owner jointly signed by manufacturer, installer and Contractor warranting work to be watertight, free from defective materials, defective workmanship, glass breakage due to defective design, and agreeing to replace components which fail within 1 year from date of Substantial Completion.
- C. Warranty shall cover following:
  - 1. Complete watertight and airtight system installation within specified tolerances.
  - 2. System is structurally sound and free from distortion.

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### 2.01 MANUFACTURERS AND PRODUCTS

- A. Subject to compliance with requirements indicated, provide products by one of the following:
1. Oldcastle BuildingEnvelope<sup>®</sup>, Terrell, TX.
- B. Acceptable Storefront Framing System:
- Series 3000 Thermal MultiPlane, glass set to the front thermally broken, loaded 2" x 4-1/2" mullion profile. For the thermal break, this system uses a two-part polyurethane polymer poured in place into a mechanically altered aluminum pocket to provide enhanced adhesion between the dissimilar materials and improved shear strength of the composite section. This system accommodates 1" glass thickness
- A. Aluminum:
1. ASTM B221, alloy 6063-T5 for extrusions; ASTM B209, alloy 5005-H16 for sheets; or other alloys and temper recommended by manufacturer appropriate for specified finish.
- B. Internal Reinforcing:
1. ASTM A36 for carbon steel.
  2. Shapes and sizes to suit installation.
  3. Steel components factory coated with alkyd type zinc chromate primer complying with FS TT-P-645.
- C. Anchorage Devices:
1. Manufacturer's standard formed or fabricated steel or aluminum assemblies of shapes, plates, bars or tubes.
  2. Hot-dip galvanize steel assemblies after fabrication; comply with ASTM A123, 2.0 ounce minimum coating.
- D. Fasteners:
1. Aluminum, non-magnetic stainless steel or other non-corrosive materials compatible with items being fastened.
  2. Provide concealed fasteners wherever possible.
  3. For exposed locations, provide Phillips flathead screws with finish matching item fastened.
  4. For concealed locations, provide manufacturer's standard fasteners.
- E. Expansion Anchor Devices: Lead-shield or toothed-steel, drilled-in, expansion bolt anchors.
- F. Protective Coatings: Cold-applied asphalt mastic complying with SSPC, compounded for 30 mil thickness for each coat; or alkyd type zinc chromate primer complying with FS TT-P-645.
- G. Touch-Up Primer for Galvanized Components: Zinc oxide conforming with FS TT-P-641.
- H. Glazing Gaskets:
1. Compression type design, replaceable, molded or extruded, of neoprene, polyvinyl chloride (PVC), or ethylene propylene diene monomer (EPDM).
  2. Profile and hardness as required to maintain uniform pressure for watertight seal.
- I. Weatherstripping:
1. Wool pile conforming to AAMA 701.2.
  2. Provide EPDM or vinylblade gasket weatherstripping in bottom door rail, adjustable for contact with threshold.
- J. Internal Sealants and Baffles.

### 2.03 GLASS AND GLAZING ACCESSORIES

- A. Refer to Section 08810.

### 2.04 FABRICATION

- A. Coordination of Fabrication:
1. Check actual frame or door openings required in construction work by accurate field measurements before fabrication.
  2. Fabricate units to withstand loads that will be applied when system is in place.
- B. General
1. Conceal fasteners wherever possible.

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2. Reinforce work as necessary for performance requirements, and for support to structure.
3. Separate dissimilar metals and aluminum in contact with concrete utilizing protective coating or preformed separators, which will prevent contact and corrosion.
4. Comply with Section 08810 for glazing requirements.

### C. Aluminum Framing:

1. Provide members of size, shape and profile indicated, designed to provide for glazing from [exterior] [interior].
2. Provide manufacturer's standard thermal break between exterior and interior aluminum surfaces.
3. Fabricate frame assemblies with joints straight and tight fitting.
4. Reinforce internally with structural members as necessary to support design loads.
5. Maintain accurate relation of planes and angles, with hairline fit of contacting members.
6. Seal horizontals and direct moisture accumulation to exterior.
7. Provide flashings and other materials used internally or externally that are corrosive resistant, non-staining, non-bleeding and compatible with adjoining materials.
8. Provide manufacturer's extrusions and accessories to accommodate expansion and contraction due to temperature changes without detrimental to appearance or performance.

### D. Welding:

1. Comply with recommendations of the American Welding Society.
2. Use recommended electrodes and methods to avoid distortion and discoloration.
3. Grind exposed welds smooth and flush with adjacent surfaces; restore mechanical finish.

### E. Flashings: Form from sheet aluminum with same finish as extruded sections. Apply finish after fabrication. Material thickness as required to suit condition without deflection or "oil-canning".

## 2.05 FINISHES

### A. Color Anodized:

1. Conforming to AA-M12C22 A44 and AAMA 611.
2. Architectural Class [I][II], etched, medium matte, [black] [dark bronze] [medium bronze] [light bronze] colored anodic coating, [0.7] [0.4] mil minimum thickness.

## PART 3 - EXECUTION

### 3.01 EXAMINATION

- A. Examine conditions and proceed with Work in accordance with Section 01400.

### 3.02 INSTALLATION

#### A. Erection Tolerances:

1. Limit variations from plumb and level:
  - a. 1/8 inch in 10'-0" vertically.
  - b. 1/8 inch in 20'-0" horizontally.
2. Limit variations from theoretical locations: 1/4 inch for any member at any location.
3. Limit offsets in theoretical end-to-end and edge-to-edge alignment: 1/16 inch from flush surfaces not more than 2 inches apart or out-of-flush by more than 1/4 inch.

#### B. Install doors and hardware in accordance with manufacturer's printed instructions.

#### C. Set units plumb, level and true to line, without warp or rack of frame.

#### D. Anchor securely in place, allowing for required movement, including expansion and contraction.

#### E. Separate dissimilar materials at contact points, including metal in contact with masonry or concrete surfaces, with bituminous paint or preformed separators to prevent contact and corrosion.

#### F. Set sill members in bed of sealant. Set other members with internal sealants and baffles to provide weather-tight construction.

#### G. Coordinate installation of perimeter sealant and backing materials between assemblies and adjacent construction in accordance with requirements of Section 07920.

#### H. Glazing: Refer to requirements of Section 08810.

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3.03 ADJUSTING

- A. Test door operating functions. Adjust closing and latching speeds and other hardware in accordance with manufacturer's instructions to ensure smooth operation.

3.04 CLEANING

- A. Clean surfaces in compliance with manufacturer's recommendations; remove excess mastic, mastic smears, foreign materials and other unsightly marks.
- B. Clean metal surfaces exercising care to avoid damage.

END OF SECTION

SECTION 08800

GLAZING

PART 1 GENERAL

1.1 SUMMARY

- A. Section Includes:
  - 1. Tinted and tempered glass.

1.2 REFERENCES

- A. American National Standards Institute (ANSI):
  - 1. ANSI Z97.1 - Safety Performance Specifications and Methods of Test for Safety Glazing Material Used in Buildings.
- B. American Society for Testing and Materials (ASTM):
  - 1. ASTM C920 - Standard Specification for Elastomeric Joint Sealants.
  - 2. ASTM C1036 - Standard Specification for Flat Glass.
  - 2. ASTM C1048 - Standard Specification for Heat-Treated Flat Glass-Kind HS, Kind FT Coated and Uncoated Glass.
  - 3. ASTM D2000 - Standard Classification System for Rubber Products in Automotive Applications.
- C. Consumer Product Safety Standards for Architectural Glazing. CPSC 16 CFR, Part 1201.
- D. Flat Glass Marketing Association (FGMA):
  - 1. FGMA - Glazing Manual and Glazing Sealing Systems Manual.

1.3 SUBMITTALS

- A. Procedures for submittals.
  - 1. Product Data:
    - a. Glass: Structural, physical and environmental characteristics, size limitations, special handling or installation requirements.
    - b. Glazing compound: Provide chemical, functional, and environmental characteristics, limitations, special application requirements.
  - 2. Samples:
    - a. Glazing: Submit one sample 12 x 12 inches (300 x 300 mm) in size of each type of glazing, illustrating tinting, and finish of glazing materials. Label each sample indicating kind, quality and manufacturer.
  - 3. Assurance/Control Submittals:
    - a. Certificates: Manufacturer's certificate that Products meet or exceed specified requirements.

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- b. Qualification Documentation: Submit documentation of experience indicating compliance with specified qualification requirements.

### 1.4 QUALITY ASSURANCE

- A. Identification: Each unit of tempered glass shall be permanently identified by the manufacturer. The identification shall be etched or ceramic fired on the glass and be visible when the unit is glazed.
- B. Perform Work in accordance with FGMA Glazing Manual.
- C. Installer Qualifications: Company specializing in performing the Work of this Section with minimum 5 years documented experience.

### 1.5 DELIVERY, STORAGE, AND HANDLING

- A. Transport, handle, store, and protect Products.

### 1.6 PROJECT CONDITIONS OR SITE CONDITIONS

- A. Environmental Requirements:
  - 1. Do not install glazing when ambient temperature is less than 40 degrees F.
  - 2. Maintain minimum ambient temperature before, during and 24 hours after installation of glazing compounds.

### 1.7 WARRANTY

- A. Procedures for closeout submittals.
- B. Special Warranty:
  - 1. Include coverage for cracking, breakage, and replacement of same.
    - a. Warranty Period: 1 year.
  - 2. Include coverage for sealed glass units from seal failure, interpane dusting or misting, and replacement of same.
    - a. Warranty Period: 10 years.

## 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. Pilkington N.A.
- B. Product options and substitutions. Substitutions: Permitted.



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**2.2 GLASS MATERIALS**

- A. Glass Type 1 – Tinted where shown on elevations, clear in windows and 1<sup>st</sup> floor storefront. Insulated Glass Units, Low E:
  - 1. Glass Thickness, Inner: 5/16 inch.
  - 2. Glass Thickness, Outer: 5/16 inch.
  - 3. Unit Thickness: 1 inch (25 mm) thick units.
  - 4. Glass to be tempered in locations required by the building code

**B. Tinted glass-Pilkington Optifloat Blue Green**

**2.3 GLAZING COMPOUNDS**

- A. Polysulphide Sealant: Two component, chemical curing, non-sagging type; cured Shore A hardness of 15-25.
- B. Silicone Sealant: Single component, chemical curing; capable of water immersion without loss of properties; non-bleeding, non-staining; cured Shore A hardness of 15-25.
  - 1. Color: Clear.
- C. Acrylic terpolymer compounded especially for glazing; non-hardening, non-staining, and non-bleeding.

**2.4 GLAZING ACCESSORIES**

- A. Setting Blocks: Resilient blocks of 70 to 90 Shore A durometer hardness; compatible with glazing sealant.
- B. Spacers: Resilient blocks of 40 to 50 Shore A durometer hardness; self adhesive on one side; compatible with glazing sealant.
- C. Filler Rods: Closed cell or jacketed foam rods of polyethylene, butyl, neoprene, polyurethane, or vinyl; compatible with glazing sealant.
- D. Joint Cleaners, Primers, and Sealers: As recommended by glazing sealant manufacturer.
- E. Gaskets: ASTM D2000, SBC 415 to 3BC 620; extruded or molded neoprene or EPDM, black.
- F. Mastic: Non-solvent type adhesive as recommended by mirrored glass manufacturer.

**PART 3 EXECUTION**

**3.1 EXAMINATION**

- A. Section 01700 - Execution Requirements: Verification of existing conditions before starting work.

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- B. Verification of Conditions: Verify that field measurements, surfaces, substrates and conditions are as required, and ready to receive Work.
  - 1. Verify that openings for glazing are correctly sized and within tolerance.
  - 2. Verify that surfaces of glazing channels or recesses are clean, free of obstructions that may impede moisture movement, weeps are clear, and ready to receive glazing.
- C. Report in writing to Architect prevailing conditions that will adversely affect satisfactory execution of the Work of this Section. Do not proceed with Work until unsatisfactory conditions have been corrected.
- D. By beginning Work, Contractor accepts conditions and assumes responsibility for correcting unsuitable conditions encountered at no additional cost to the Owner.

### 3.2 PREPARATION

- A. Clean contact surfaces with solvent and wipe dry.
- B. Seal porous glazing channels or recesses with substrate compatible primer or sealer.
- C. Prime surfaces scheduled to receive sealant.

### 3.3 GLAZING

- A. Install glazing from interior only. No exterior glazing permitted. No glazing removal permitted from exterior.
- B. Locate setting blocks at quarter points of sill; set in sealant if heel or toe bead is required.
- C. Install spacers inside and out except where preshimmed tape or glazing gaskets are to be used.
- D. Set each piece in a series to other pieces in pattern draw, bow, or other visually perceptible characteristics.
- E. Provide glazing sealants and gaskets as required for particular glazing application. Coordinate with other Sections for material compatibility.
- F. Gaskets:
  - 1. Provide adequate anchorage, particularly for driven-in wedge gaskets.
  - 2. Miter and weld ends of channel gaskets at corners to provide continuous gaskets.
  - 3. Seal face gaskets at corners with sealant to close opening and prevent withdrawal of gaskets from corners.
- G. Do not leave voids in glazing channels except as specifically indicated or recommended by glass manufacturer. Force sealant into channel to eliminate voids. Tool exposed surfaces to slight wash away from joint. Trim and clean promptly.

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- H. Do not allow sealant to close weeps of aluminum framing.
  - I. Provide filler rod where sealants are used in the following locations:
    - 1. Head and jamb channels.
    - 2. Colored glass over 75 united inches in size.
    - 3. Clear glass over 125 united inches in size.
- 3.4 CONSTRUCTION
- A. Interface with Other Work: Coordinate glazing with installation of entrances and storefronts specified in Section 08400.
- 3.5 FIELD QUALITY CONTROL
- A. Inspect preparation and installation of glass.
- 3.6 CLEANING
- A. Remove glazing materials from finish surfaces.
  - B. Remove labels after Work is complete.
  - C. Clean glass and adjacent surfaces.
- 3.8 PROTECTION
- A. After installation, mark pane with an 'X' by using removable plastic tape or paste.

END OF SECTION

**SECTION 09250**

**GYPSUM BOARD**

1. GENERAL

1.1 REFERENCES:

- A. Drawings and general provisions of Contract, including General Conditions and Division 1 specifications, apply to work in this section.
- B. NOTE: Selection of Finish colors and patterns in overall color scheme to be made by Architect. Contractor to notify Architect prior to commencing Gypsum Board work, to allow adequate time for color selections, Owner's approval and material ordering lead time.
- C. Related Sections:
  - 1. Section 07 84 00 (07480) - Firestopping
  - 2. Section 07 92 00 (07920) – Joint Sealants
  - 3. Section 09 21 16 (09255) - Gypsum Board Assemblies
  - 4. Section 09 90 00 (09900) – Painting
  - 5. Division 1 Section “Site Waste Management Program”

1.2 DESCRIPTION OF WORK: The extent of work shall be as shown on Drawings and called for in these Specifications. Performance shall meet the requirements of these Specifications. The work covered by this section of Specifications consists of the following:

- A. Drywall installation as required by Drawings and noted in these Specifications.
- B. Taping and finishing all walls and ceilings, except where other kind of finish is specified.

2. PRODUCTS

- 2.1 NOTE: GWB types are shown as U.S.G. brand names “Sheetrock”, “Firecode”, “Firecode C”, “M.R. Board” and “Shaftwall”. Substitutions must have equal U.L. and STC ratings. See Drawings for Specific assembly.
- 2.2 EXTERIOR & INTERIOR WALLS & CEILINGS: See rated & non rated assemblies and wall types on the drawings.
- 2.3 NOTE: Type M.R. in toilet rooms, walls and ceiling.
- 2.4 RESILIENT CHANNEL: USG-RC-1 – Refer to Drawings for type and locations.

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2.5 Minimum drywall thickness for walls or ceilings shall be ½ inch. If support member spacing exceeds 16" on center the minimum thickness shall be 5/8 inch.

### 2.6 STEEL FRAMING COMPONENTS FOR SUSPENDED AND FURRED CEILINGS

#### B. Manufacturers of Grid Suspension Systems

1. Approved Manufacturers:
  - a. Chicago Metallic Corp., or equal.

C. General: Provide components complying with ASTM C754 for conditions indicated.

D. Grid Suspension System for Interior Ceilings: ASTM C645, manufacturer's standard direct-hung grid suspension system composed of main beams and cross furring members that interlock to form a modular supporting network.

E. Wire for Hangers and Ties: ASTM A641, Class 1 Zinc Coating, Soft Temper, minimum 0.162 inch diameter.

F. Hanger Rods: ASTM A510 mild steel and zinc coated or protected with rust-inhibitive paint. Diameter as indicated.

G. Channels: Cold-rolled steel, 0.0538-inch-minimum thickness of base (uncoated) metal and 1/2-inch-wide flanges, and as follows:

1. Carrying Channels: 2 inches deep, 590 lb. per 1,000 feet, unless otherwise indicated.
2. Furring Channels: 3/4 inch deep, 300 lb. per 1,000 feet, unless otherwise indicated.
3. Finish: G-60 hot-dip galvanized coating per ASTM A653 for framing for toilet rooms and where indicated.
  - a. Rust-inhibitive paint, unless otherwise indicated.

### 3. EXECUTION

3.1 THE DRYWALL CONTRACTOR shall inspect all areas affected by his work to ascertain that all work is complete and has been accepted. Defective installations shall be corrected before finished surfaces are painted or sprayed with acoustical material.

3.2 DRYWALL INSTALLATION. Install drywall as shown on plans, noted in the UL Specifications, and as set forth in U.S.G. Handbook. Installation of non-UL rated drywall assemblies on steel studs shall comply with the following minimum requirements:

- A. Spacing for attachment members shall not exceed 24" o.c. for walls and 16" o.c. for ceilings. All drywall shall be screwed with approved drywall screws made specifically for the purpose and of length adequate for wall types. On walls, screws shall not be placed more than 16" apart for 16" o.c. framing or 12" apart for 24" o.c. framing. Screw all edges 12" o.c. maximum.
- B. The drywall contractor may use a few drywall nails to temporarily secure a sheet of drywall before securing with drywall screws. In this event, the drywall nails must be countersunk prior to taping. Corner beads shall be used on all corners and casing beads used whenever Gypsum Board abuts dissimilar material. Caulking to also be applied at these junctions. At all party and unit/corridor walls, Gypsum Board to be set in caulking (for sound).

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- C. Drywall shall be laid vertically or horizontally. No tapered joints at floor base.
- D. Note: Gypsum board to be installed behind all tubs and shower units which results in double gypsum board on some bathroom walls. See bathroom drawing sheet.
- E. Provide 1/4" to 1/2" open joint base and where drywall meets wood ceilings at unit demising walls, exterior walls, and corridor walls for air sealant.
- F. Ceiling suspension system:
  - 1. Space hangers not over 48 in. o.c. in direction of main runner channels, and within 6 in. of ends of main runner runs and of boundary walls, structural steel, partitions, and similar interruptions of ceiling continuity. Install additional hangers at ends of each suspension member and at ceiling equipment not separately suspended, 6 in. from vertical surfaces. Do not splay wires more than 5 in. in a 4 ft. vertical drop. Wrap wire a minimum of three times horizontally, turning ends upward.
  - 2. Attach hangers directly to ceiling structure, or to supplementary framing members supplied and installed under this section. Hangers may not be suspended from mechanical or electrical equipment such as ductwork, conduit or piping.
  - 3. Install 1-1/2 in. main runner channels spaced not over 48 in. o.c. within 6 in. of wall. Position channels for proper ceiling height, level and secure, with hanger wire saddle-tied along channel. Provide 1 in. clearance between runners and abutting walls and partitions. At channel splices, interlock flanges, overlap ends 12 in., and secure each end with double-strand 18 ga. tie wire.
  - 4. Erect 3/4 in. metal furring channels at right angles to main runner channels or main support members. Space furring not over 16 in. o.c., and within 6 in. of wall. Provide 1 in. clearance between furring ends and abutting walls and partitions. Secure furring to carrying channels with clips or saddle-tie to supports with double strand 18 ga. tie wire. At splices, next furring channels at least 8 double-strand 18 ga. tie wire.
  - 5. At openings interrupting main or furring channels, install additional cross-reinforcing as required, to restore lateral stability of ceiling framing system.
  - 6. Finished installations shall be level to within 1/4 in. in 10 ft.

3.3 ON SURFACES TO BE PAINTED: tape and cement all joints and screw locations with three coats of compound, then sand to smooth finish, acceptable to paint.

3.4 DURING WORK PROGRESS, remove all excess materials and debris resulting from operations, which may disrupt the work of other trades and after completion leave the premises broom clean.

END OF SECTION

SECTION 09260

**GYPSUM BOARD ASSEMBLIES ON METAL FRAMING**

PART 1 - GENERAL

1.1 SUMMARY

- A. Description of Work: Work of this section includes, but is not limited to, the following:
  1. Gypsum board and accessories
  2. Metal studs and furring
  3. Metal shaftwall systems
  4. Metal suspension systems
  5. Sound-rated construction and accessories
  6. Gypsum board finishing
  7. Trim and accessories

1.2 RELATED WORK SPECIFIED ELSEWHERE

- A. See Section 09900 PAINTING AND FINISHING for gypsum board prime and finish coats.

1.3 SUBMITTALS

- A. Product Data: Submit manufacturer's specifications and installation instructions with project conditions and materials clearly identified or detailed for each required system.

1.4 SYSTEM REQUIREMENTS

- A. Performance Requirements: Fabricate and install systems as indicated but not less than that required to comply with ASTM C754 under the following conditions:
  1. Gypsum board partitions:
    - a. Standard systems: Maximum deflection of  $l/240$  of partition height.
  2. Cavity shaftwall systems: Withstand minimum positive and negative pressure of 5 psf.
  3. Interior suspended ceilings and soffits: Maximum deflection of  $l/360$  of distance between supports.
  4. Nonstructural components that are permanently attached to structures and their support attachments, shall be designed and constructed to resist the effects of earthquake motions in accordance to local jurisdiction.
- B. Fire Resistance Ratings: Where fire resistance classifications are indicated, provide materials and application procedures identical to those listed by UL or tested according to ASTM E119 for type of construction shown.
- C. Acoustical Ratings: Where sound ratings are indicated, provide materials and application procedures identical to those tested by manufacturer to achieve Sound Transmission Class (STC) scheduled or indicated in accordance with ASTM E90.

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### 1.5 QUALITY ASSURANCE

#### A. Reference Standards:

1. Applicable requirements of ASTM C754 for installation of steel framing.
2. Install gypsum board in accordance with applicable requirements and recommendations of Gypsum Association GA 216, "Recommended Specifications for the Application and Finishing of Gypsum Board" except for more stringent requirements of manufacturer.
3. Apply acoustical sealant in accordance with applicable requirements of ASTM C919.

### 1.6 DELIVERY, STORAGE AND HANDLING

#### A. Delivery:

1. Deliver material to site promptly without undue exposure to weather.
2. Deliver in manufacturer's unopened containers or bundles, fully identified with name, brand, type and grade.

#### B. Storage:

1. Store above ground in dry, ventilated space.
2. Protect materials from soiling, rusting and damage.

### 1.7 PROJECT CONDITIONS

#### A. Environmental Requirements:

1. Do not install gypsum board when ambient temperature is below 40°F.
2. For adhesive attachment of gypsum board, and for finishing of gypsum board, maintain ambient temperature above 55°F from one week prior to attachment or joint treatment, and until joint treatment is complete and dry.

## PART 2 - PRODUCTS

### 2.1 PRODUCTS AND MANUFACTURERS

- A. Gypsum Board and Accessories: Listed products establish standard of quality and are manufactured by United States Gypsum Company (USG), Chicago, IL. Or approved equal.
- B. Steel Framing and Furring: Company acceptable to installer.
- C. Grid Suspension Assemblies: Listed products establish standard of quality and are manufactured by United States Gypsum Company (USG), Chicago, IL. Or approved equal.

### 2.2 BOARD MATERIALS

#### A. Gypsum Board:

1. ASTM C1396 (Section 5), regular type except where Type X fire-resistant type is indicated or required to meet UL assembly types.
2. Edges: Tapered.
3. Acceptable products:



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- a. Typical partitions and ceilings: Equivalent to SHEETROCK® brand SW, FIRECODE® or FIRECODE® "C" Core gypsum panels by USG.
  - b. OR Equivalent to SHEETROCK® brand Regular, FIRECODE® or FIRECODE® "C" Core gypsum panels by USG.
  - c. Acceptable product for fire-rated walls: Equivalent to ULTRACODE® Core, 3/4 inch thick, by USG.
  - d. Use gypsum board and joint compound with little or no VOCs and formaldehyde emissions. Gypsum board shall have a minimum of 5% Post-consumer and 20% Post-industrial (nation-wide average for company) as defined by FTC (Federal Trade Commission) by USG.
- B. Moisture & Mold Resistant
1. ASTM C1396 (Section 5), regular type except where Type X fire-resistant type is indicated or required to meet UL assembly types.
  2. Edges: Tapered.
  3. Thickness: 5/8 inch.
  4. Acceptable products: Sheetrock® brand Mold Tough™ Firecode (Type X), Firecode® C Core or ULTRACODE® Core gypsum panels by USG.
- C. Shaftwall:
1. Liner boards:
    - a. ASTM C442, Type SLX.
    - b. Edges: Beveled.
    - c. Thickness: 1 inch.
    - d. Acceptable product: Equivalent to SHEETROCK® gypsum liner panels by USG.
  2. Face boards:
    - a. ASTM C1396 (Section 5), Type X.
    - b. Thickness: 1/2 inch, unless otherwise indicated.
    - c. Acceptable product: Equivalent to SHEETROCK® FIRECODE® C Core and FIRECODE® Core gypsum panels by USG.

### 2.3 METAL FRAMING AND FURRING MATERIALS

- A. Metal Studs and Runners:
1. ASTM C645, "C" shaped, gauge:
    - a. Provide gauge as indicated for studs; runner gauge as recommended by stud manufacturer.
    - b. Provide runner gauge as recommended by stud manufacturer.
  2. Depth of sections: As indicated.
  3. Corrosion protection: G40 hot-dipped galvanized coating per ASTM A525.
- B. Shaft Wall Supports:
1. Conform to ASTM A446, Grade A, with G40 hot-dipped galvanized coating per ASTM A525.
  2. Studs:
    - a. Shape: "CH", or as standard with manufacturer.
    - b. Gauge: As required to fulfill performance criteria, minimum 25 gauge. Provide 20 gauge for jamb and lintel components.
    - c. Size: As indicated.
    - d. J runners: 24 gauge, size as required for coordination with studs.
    - e. Jamb struts: 20 gauge with 3 inch back leg for use at elevator frames.

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### C. Metal Furring Channels:

1. Hat-shaped:
  - a. ASTM C645, 7/8 inch high, 25 gauge, with G40 hot-dipped galvanized coating per ASTM A525.
  - b. Provide 20 gauge at furring to receive tile backer board.
  - c. Acceptable products: DWC-25 for ½" and 5/8" gypsum board and DWC-20 by USG.
2. Z-shaped: ASTM C645, depths as indicated, 24 gauge minimum, with G40 hot-dipped galvanized coating per ASTM A525.
3. Resilient: Manufacturer's standard type designed to reduce sound transmission; 1/2 inch deep, 25 gauge steel with G40 hot-dipped galvanized coating per ASTM A525.

## 2.4 CEILING AND SOFFIT SUPPORT MATERIALS

A. Hanger Anchorage Devices: Screws, clips, bolts or other devices compatible with indicated structural anchorage for ceiling hangers and whose suitability has been proven through standard construction practices or by certified test data.

### B. Hangers:

1. Steel wire or rods, sizes to comply with requirements of ASTM C754 for ceiling or soffit area and loads to be supported.
2. Wire: ASTM A 641, soft, Class 1 galvanized.
3. Rods and flats:
  1. Mild steel components.
  2. Finish: Galvanized or painted with rust-inhibitive paint for interior work; galvanized for exterior work.

### C. Framing System:

1. Main runners:
  1. Cold-rolled, "C" shaped steel channels, 16 gauge minimum.
  2. Finish: Galvanized or painted with rust-inhibitive paint for other interior work.
2. Cross furring: Hat-shaped steel furring channels, ASTM C645, 7/8 inch high, 25 gauge, galvanized.
3. Furring anchorages: 16 gauge galvanized wire ties, manufacturer's standard wire-type clips, bolts, nails or screws recommended by furring manufacturer and complying with ASTM C754.
4. Provide compression posts and other accessories as required to comply with seismic requirements.

### D. Proprietary Framing System:

1. Framing system for gypsum board panels consisting of cold-rolled steel members conforming to ASTM C635, with exposed surfaces finished in manufacturer's standard enamel paint finish.
2. Fire rating: 1 hour rating in accordance with UL assembly indicated.
3. Components: Main tees, furring cross channels, furring cross tees, and cross tees.
4. Accessories:
  - a. U-shaped channel molding.
  - b. Galvanized carbon steel (12 ga.) hanger wire.

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5. Acceptable product: Equivalent to Drywall Suspension System by USG.

### 2.5 ACCESSORIES

- A. Metal Trim for Gypsum Board:
  1. Conform to profile and dimensions indicated.
  2. Material for interior work: Galvanized steel, 26 gauge minimum.
  3. Corner beads: Equivalent to Dur-A-Bead No. 103 by USG.
  4. Casing beads (edge beads): Equivalent to 200A by USG.
  5. J-Beads.
- B. Adhesives and Joint Treatment Materials:
  1. Conform to requirements of ASTM C475.
  2. Joint compounds:
    - a. Drying-type (ready-mixed): Equivalent to SHEETROCK® brand taping joint compound and topping joint compound, or SHEETROCK® all purpose joint compound [or ready-mixed lightweight all purpose joint compound by USG.
- C. Gypsum Board Screws: Self-drilling, self-tapping steel screws.
  1. For steel framing less than 0.03 inch thick: Comply with ASTM C1002.
  2. For steel framing from 0.033 inch thick to 0.112 inch thick: Comply with ASTM C954.
  3. Provide Type S or Type S-12 screws.
- D. Backer Board Accessories: Provide accessories and corrosion-resistant-coated steel screws as recommended by backer board manufacturer and required for complete installation.
- E. Acoustical Sealant: Equivalent to SHEETROCK® acoustical sealant by USG.
- F. Miscellaneous Accessories: Provide as required for complete installations.

## PART 3 - EXECUTION

### 3.1 EXAMINATION

- A. Examine substrates and adjoining construction and conditions under which work is to be installed. Do not proceed with work until unsatisfactory conditions are corrected.

### 3.2 GENERAL INSTALLATION REQUIREMENTS

- A. Install in accordance with reference standards and manufacturer's instructions [and as required to comply with seismic requirements].
- B. Tolerances:
  1. Do not exceed 1/8 inch in 8'-0" variation from plumb or level in exposed lines of surface, except at joints between gypsum board units.
  2. Do not exceed 1/16 inch variation between planes of abutting edges or ends.
  3. Shim as required to comply with specified tolerances.

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- C. Install framing to comply with ASTM C754 and with ASTM C840 requirements that apply to framing installation.
- D. Install supplementary framing, blocking and bracing at terminations in gypsum board assemblies to support fixtures, equipment, heavy trim, grab bars, toilet accessories, furnishings or similar construction.

### 3.3 METAL SUPPORT INSTALLATION

- A. Metal Runners:
  - 1. Align and secure runner tracks accurately to partition layout at both floor and ceiling.
  - 2. Provide fasteners appropriate to substrate construction as recommended by manufacturer.
- B. Metal Studs:
  - 1. Position metal studs vertically in the runners, spaced as indicated.
  - 2. Place studs so that flanges face in same direction.
  - 3. Cut studs 1/2 inch short of full height to provide perimeter relief.
  - 4. Align and plumb partition framing accurately.
  - 5. Where partitions abut ceiling or deck construction or vertical structural elements, provide slip or cushion type joint between partition and structure as recommended by stud manufacturer to prevent transfer of structural loads or movements to partitions, and to provide lateral support.
  - 6. Provide horizontal bracing where necessary for lateral support.
  - 7. Chase walls:
    - a. Position steel studs on opposite sides of chase directly across from each other.
    - b. Cut cross-bracing from gypsum board 12 inches high by chase wall width.
- C. Ceiling and Soffit Support Systems:
  - 1. Secure hangers or rods to structural support by connecting directly to structure where possible; otherwise connect to inserts, clips or other anchorage devices or fasteners indicated.
  - 2. Space main runners, hangers and furring according to requirements of ASTM C754, except as otherwise indicated.
  - 3. Where spacing of structural members, or width of ducts or other equipment, prevents regular spacing of hangers, provide supplemental hangers and suspension members and reinforce nearest affected hangers to span extra distance.
  - 4. Install compression posts, splay wires and other accessories as required to comply with seismic requirements.
  - 5. Extend runners to within 6 inches of walls.
  - 6. Wire-tie or clip furring members to main runners and to other structural supports indicated. In fire resistance rated assemblies, wire-tie furring members; do not clip.
  - 7. Do not permit furring or runners to contact masonry or concrete walls.
  - 8. Provide 1 inch clearance between furring or runners and abutting walls and partitions.

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### 3.4 FINISHING

- A. Provide levels of gypsum board finish for locations as follows, in accordance with Gypsum Association GA 214, "Recommended Specification: Levels of Gypsum Board Finish".
  - 1. Level 1: Ceiling plenum areas and concealed areas, except provide higher level of finish as required to comply with fire resistance ratings and acoustical ratings.
  - 2. Level 2: Gypsum board substrate at tile [stone], except remove tool marks and ridges.
  - 3. Level 3: Gypsum board surfaces, where textured finishes or heavy vinyl wall papering will be used [High-build Primer required as specified in Section 09911 or USG First Coat primer].
  - 4. Level 4: Gypsum board surfaces, except where another finish level is indicated High-build Primer required as specified in Section 09911 or USG First Coat primer.

**END OF SECTION**

SECTION 09900

PAINTING

1. GENERAL

1.1 DESCRIPTION OF WORK

- A. Drawings and general provisions of Contract, including General Conditions and Division 1 specifications, apply to work in this section.
- B. The extent of work shall be as shown on Drawings and called for in these Specifications. Performance shall meet the requirements of these Specifications. The work covered by this section of Specifications consists of the following:
  - 1. Painting or staining all interior and exterior surfaces in these Specifications.
  - 2. Painting interior walls, door trim, window trim, etc.
  - 3. Painting rails as called for on Drawings.
  - 4. Painting all exterior doors as specified.
  - 5. Painting and finishing any other work requiring finishing left unfinished by others.
  - 6. Walls painted accent as called for on Drawings.
  - 7. Frames and exterior doors.
- C. Volatile Organic Compound (VOC) emissions from paints & coatings must not exceed the VOC limits of Green Seal's Standards GS-11 requirements.
  - 1. Non-flat: 150 g/l
  - 2. Flat: 50 g/l

NOTE: All colors to be selected by Architect. The Contractor shall submit to the Architect, for approval, color samples of stain finishes, See general Note Section 09250.

1.2 SUBMITTALS

- A. Issue submittals in accordance with Section 01300, Submittals.
- B. Submit as follows:
  - 1. Manufacturer's data, application instructions, and color chips on all specified products.
  - 2. Paint schedule covering all surfaces to be painted.

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3. Contractor to provide 4' x 8' test panels in finished spaces for up to 3 trials for each required color selection. Test panel colors to be selected by Architect. Final color to be approved by Architect from test panels.
4. Provide as maintenance material, a minimum of one gallon of each type and color of paint used on job, in labeled and well-sealed containers, for future touch-up. Also provide typed list of each type and color of paint used on job, including name of distributor from whom paint may be obtained.

## 2. PRODUCTS

### 2.1 General

- A. Paint: See schedule.

### 2.2 MATERIALS

- A. Where primer is called for, use primer recommended by manufacturer for particular combination of substrate and finish coat. Where painting over shop-applied primers, verify that finish paint proposed for field application is compatible with shop primers actually used. Primer on gyp board at exterior walls to be low perm or .5.
- B. Exterior Doors: Steel-Clad: Benjamin Moore Ironclad Retardo
- C. All Gypsum Walls and Ceilings to be painted: Primer - Benjamin Moore Vinyl Latex Primer Sealer.
- D. Finish-Walls - Benjamin Moore Moorcraft Latex Eggshell.
- E. Finish Ceiling – Flat Ceiling White Latex
- F. Interior exposed softwood woodwork as noted on Drawings: One (1) coat Primer; two (2) finish coats Semigloss Latex. All Hardwood: three (3) coats urethane.
- G. Interior Door Frames & Trim, & Miscellaneous interior wood trim: Benjamin Moore Wood Primer and two (2) coats Latex Semigloss.

## 3. EXECUTION

### 3.1 JOB CONDITIONS

- A. Store materials in sealed containers. Provide a fire extinguisher in storage room. Remove flammable rags and waste from building at end of day.
- B. Do not perform exterior work in rain or when precipitation is forecast imminently; or in hot, dry, or windy weather which would cause finish to cure too rapidly, or be marred by windstorm dust; or at temperatures below 40 degrees F.

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- C. Maintain temperature at interior locations between 50 and 75 degrees F, maximum 80 percent relative humidity, while paint is being applied. Provide adequate ventilation, by mechanical means if necessary, for drying of paint and prevention of condensation and mildew. Do not apply finish in areas in which dust is being generated.
- D. Protect finished surfaces and equipment not being painted with masking tape, canvas drop cloths, polyethylene sheets, etc. Items such as lighting switch covers, fixture canopies, and door handles shall be temporarily removed, carefully stored, and replaced after painting, or carefully covered during painting operations.

### 3.2 PREPARATION

- A. Preparation of newly-installed materials to receive finish painting is specified under those Sections installing materials. This includes, but is not necessarily limited to: touch-up of damaged shop coats; taping, sealing and sanding of drywall; patching masonry; sanding finish wood; and cleaning off grease, oil, dirt, mildew, factory-applied protective coatings, and other foreign materials.
- B. At wood surfaces to be painted, scrape and clean small, dry, seasoned knots, and apply a thin coat of white shellac or other recommended knot sealer, before application of priming coat. After priming, fill holes and imperfections in finish surfaces with putty or plastic wood-filler. Sandpaper smooth when dried. Caulk all interplay between wood trim, door frames and base boards with gyp board.
- B. Before beginning work under this Section, verify that preparation of substrates under other Sections has been done as specified. Thoroughly remove water, dirt, and dust with clean cloths, brooms, or brushes. Allow masonry mortar joints to cure as long as possible before beginning paint application, 7 days minimum, 28 days preferably.

### 3.3 APPLICATION

- A. Apply all materials in accordance with the manufacturer's recommendations.
- B. Apply materials with suitable brushes, rollers, and spraying equipment. Keep application equipment clean, dry, and free from contaminants. Thoroughly stir materials before applying, and periodically during application.
- C. Rate and method of application and drying time between coats shall be strictly in accordance with manufacturer's recommendations.
- D. Prepare field test panels in accordance with paragraph 1.4-B.3 of this Section for each type and color of finish specified. Request review of first completed room, color scheme, special items, etc., which shall serve as project standard after approval.
- E. Touch-up shop applied primers before field painting.
- F. Do not apply first coat until surface is dry to touch. Moisture content of surface shall be within limitations recommended by paint manufacturer.



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- G. Leave all parts of moldings and ornaments clean and true to detail, without excessive paint in corners and depressions. Make edges of paint adjoining other materials or colors clean and sharp with no overlapping. Paint surfaces visible through grilles one coat flat black.
- H. Finish coats shall be smooth, free of brush marks, streaks, laps or pile-up of paint, and skipped or missed areas. Refinish whole wall if unacceptable finish is extensive or of such a nature that it cannot be repaired by normal touch-up.
- I. After completion of painting work, remove spilled or spattered paint. Touch-up and repair finishes damaged in any way by work under this Section. Protect finished surfaces.

### 3.4 Exterior

- A. Exterior and interior - Steel-Clad door: Two (2) coats exterior enamel over factory primer. Doors shall be laid flat if sprayed. Doors may be rolled or brushed in place, however with no visible brush marks, drips or imperfections.
- B. All exterior metal work (steel) to include railings, brackets and grids.
  - a. Alkyd Systems  
Gloss Finish
    - 1<sup>st</sup> Coat: S-W All surface Enamel Primer, A11w210
    - 2<sup>nd</sup> Coat: S-W All Surface Enamel, A11 Series
    - 3<sup>rd</sup> Coat: S-W All Surface Enamel, A11 Series  
(4 mils wet, 1.6 mils dry per coat)

### 3.5 Interior

- A. Interior Painting: Paint shall be applied in the following number of coats, primer and finish. Tint all primers to match finish color.
  - 1. One (1) fully applied finish coat of even coverage. NOTE: Contractor to adequately cover M.R. (Blueboard) or other colored drywall by primer or finish coat as necessary to eliminate any visible "bleed through".
  - 2. Drywall: All interior walls to receive paint: one (1) coat latex base primer-sealer, two (2) finish coats latex eggshell. Ceiling: One (1) coat primer and two (2) coats latex flat.
  - 3. Concrete Block: One (1) coat latex base primer, two (2) finish coats latex eggshell finish.
- B. Interior Window Sill, Door Frames & Trim, and Miscellaneous Interior Wood Trim- one (1) coat primer and two (2) coats finish for all soft wood.
- C. All hardwood to receive three (3) coats urethane.

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END OF SECTION

PAINT SCHEDULE												
DESCRIPTION			MANUFACTURER									
Type & Surface	Luster	No. of Coats	SHERWIN-WILLIAMS		PRATT & LAMBERT		BENJAMIN MOORE		MARTIN SENOUR		ICI PAINTS	
			Products	Dry Mil Thickness (Per Coat)	Products	Dry Mil Thickness (Per Coat)	Products	Dry Mil Thickness (Per Coat)	Products	Dry Mil Thickness (Per Coat)	Products	Dry Mil Thickness (Per Coat)
1. Interior Ferrous Metal (Not Galvanized and Shop Primed)	Acrylic Latex Semi-Gloss	1	DTM Acrylic Primer / Finish (B66W1)	3.00	Suprime "3" Int/Ext Latex Metal Primer (Z/F1003)	1.25	Acrylic Metal Primer (M04) (As Required)	1.50	TPS Int/Ext Latex Primer	1.20	DEVFLEX DTM Primer & Flat Finish (4020PF)	2.00
		2	ProClassic Waterborne Acrylic Semi-Gloss (B31 Series)	1.30	Accolade Interior Semi-Gloss (Z/F4100 Series)	1.50	DTM Acrylic Semi Gloss Enamel (M29)	1.50	Platnum Interior Satin Gloss	1.30	DULUX ULTRA Semi-Gloss Acrylic Interior Wall & Trim Enamel (1407-XXXX)	1.50
2. Interior Ferrous Metal (Galvanized)  (Note: Spot prime as required)	Acrylic Latex Semi-Gloss	1	DTM Acrylic Primer / Finish (B66W1)	3.00	Suprime "3" Int/Ext Latex Metal Primer (Z1003)	1.25	Acrylic Metal Primer (M04) (As Required)	1.50	Super Tough Coat Latex Primer/Finish	1.25	DEVFLEX DTM Primer & Flat Finish (4020PF)	2.00
		2	ProClassic Waterborne Acrylic Semi-Gloss (B31 Series)	1.30	Accolade Interior Velvet (Z/F4000 Series)	1.50	DTM Acrylic Semi Gloss Enamel (M29)	1.50	Platinum Interior Eggshell	1.30	DULUX ULTRA Semi-Gloss Acrylic Interior Wall & Trim Enamel (1407-XXXX)	1.50
		2	ProClassic Waterborne Acrylic Semi-Gloss (B31 Series)	1.30	Accolade Interior Semi-Gloss (Z/F4100 Series)	1.50	DTM Acrylic Semi Gloss Enamel (M29)	1.50	Platnum Interior Satin Gloss	1.30	DULUX ULTRA Semi-Gloss Acrylic Interior Wall & Trim Enamel (1407-XXXX)	1.50
3. Interior Pipes, Ductwork & Mechanical Equipment (Not Galvanized)	Acrylic Latex Eggshell	1	DTM Acrylic Primer / Finish (B66W1)	3.00	Suprime "3" Int/Ext Latex Metal Primer (Z1003)	1.25	Fresh Start All Purpose Primer (023)	1.20	Super Tough Coat Latex Primer/Finish	1.25	DEVFLEX DTM Primer & Flat Finish (4020PF)	2.00
		1	ProMar 200 Interior Latex Eg-Shel (B20W2200 Series)	1.50	Accolade Interior Velvet (Z/F4000 Series)	1.50	Super Spec Latex Eggshell Finish (274)	1.30	Platnum Interior Eggshell	1.30	ULTRA-HIDE 1412-XXXX Latex Eggshell Interior Wall & Trim Enamel (1412-XXXX)	1.30
4. Interior Pipes, Ductwork & Mechanical Equipment (Galvanized)	Acrylic Latex Eggshell	1	DTM Acrylic Primer / Finish (B66W1)	3.00	Suprime "3" Int/Ext Latex Metal Primer (Z1003)	1.25	Fresh Start All Purpose Primer (023)	1.20	Super Tough Coat Latex Primer/Finish	1.25	DEVFLEX 4020PF DTM Primer & Flat Finish	2.00
		1	ProMar 200 Interior Latex Eg-Shel (B20W2200 Series)	1.50	Accolade Interior Velvet (Z/F4000 Series)	1.50	Super Spec Latex Eggshell Finish (274)	1.30	Platnum Interior Eggshell	1.30	ULTRA-HIDE 1412-XXXX Latex Eggshell Interior Wall & Trim Enamel	1.30

DESCRIPTION			MANUFACTURER											
Type & Surface	Luster	No. of Coats	SHERWIN-WILLIAMS		PRATT & LAMBERT		BENJAMIN MOORE		MARTIN SENOUR		ICI PAINTS			
			Products	Dry Mil Thickness (Per Coat)	Products	Dry Mil Thickness (Per Coat)	Products	Dry Mil Thickness (Per Coat)	Products	Dry Mil Thickness (Per Coat)	Products	Dry Mil Thickness (Per Coat)		
5. Interior Gypsum Board (New)	Acrylic Latex Eggshell	1	PrepRite 200 Latex Primer (B28W200)	1.10	Suprime "4" Interior Latex Wall Primer (Z1004)	1.50	Super Spec Latex Enamel Undercoater/Primer (253)	1.20	TPS Int/Ext Latex Primer	1.20	PREP & PRIME HI-HIDE Interior Water-Based Primer Sealer (1000-1200)	1.50		
		2	ProMar 200 Interior Latex Eg-Shel (B20W2200 Series)	1.20	Accolade Interior Velvet (Z/F4000 Series)	1.50	Super Spec Latex Eggshell Finish (274)	1.30	Platnum Interior Eggshell	1.30	ULTRA-HIDE Latex Eggshell Interior Wall & Trim Enamel (1412-XXXX)	1.30		
6. Interior Gypsum Board - Ceilings (New)	Acrylic Latex Flat	1	PrepRite 200 Latex Primer (B28W200)	1.10	Suprime "4" Interior Latex Wall Primer (Z1004)	1.50	Super Spec Latex Enamel Undercoater/Primer (253)	1.20			DULUX ULTRA Basecoat Interior Latex Wall Primer (1000-1200)	1.50		
		2	ProMar 200 Interior Latex Flat (B30-200 Series)	1.30	Accolade Interior Acrylic Latex Flat (PZ/PF4600 Series)	1.60	Super Spec Latex Flat (275)	1.20			DULUX ULTRA Velvet Sheet Flat Latex Interior Wall & Trim Finish (1201-XXXX)	1.50		
7. Interior Gypsum Board or Plaster (New)	Acrylic Latex Eggshell	1	<b>Harmony Interior Latex Primer (B11W900)</b>	<b>1.30</b>			Eco Spec Primer Sealer (231)	0.80			PREP & PRIME ODOR-LESS Interior Water-Based Primer Sealer (LM9116)	1.20		
		2	<b>Harmony Interior Latex Eg-Shel (B9 Series)</b>	<b>1.60</b>			Eco Spec Eggshell Enamel (223)	1.40			LIFEMASTER 2000 Interior Eggshell (LM9300)	1.50		
		2	<b>Duration Home Interior Satin (A97WQ8151)</b>	1.20	Accolade Interior Velvet (Z/F4000 Series)	1.50	Regal Matte Finish Latex (221)	1.30	Platnum Interior Eggshell	1.30	ULTRA-HIDE Latex Eggshell Interior Wall & Trim Enamel (1412-XXXX)	1.30		
8. Interior Gypsum Board or Plaster (New or Previously Painted)	Acrylic Latex Satin	1	PrepRite Classic Interior Latex Primer (B28W101)	1.60	Suprime "12" Interior Alkyd Wall Primer (D/D1012)	1.50	Fresh Start All-Purpose Latex Primer (023)	1.10	TPS Interior Alkyd Undercoater	1.50	PREP & PRIME WALL & WOODWORK 100% Acrylic Interior Water-Based Primer Sealer (1020-1200)	1.10		
		2	<b>Duration Home Interior Satin (A97WQ8151)</b>	1.20	Accolade Interior Velvet (Z/F4000 Series)	1.50	Regal Aqua Pearl (310)	1.30	Platnum Interior Eggshell	1.30	DULUX ULTRA Eggshell Acrylic Interior Wall & Trim Enamel (1403)	1.60		
9. Interior Gypsum Board or Plaster	Epoxy Satin Eggshell	1	PrepRite 200 Interior Latex Primer (B28W200)	1.10	Suprime "1" 100% Acrylic Multi-Purpose Primer (Z1001)	1.50	Super Spec Latex Vapor Barrier Primer Sealer (260)	1.00	TPS Int/Ext Latex Primer	1.20	PREP & PRIME GRIPPER Multi-Purpose Water-Based Primer Sealer (3210-1200)	1.90		
		2	Water Based Catalyzed Epoxy (B70-200 Series)	2.50 - 3.00	Tech-Gard Waterborne Epoxy (Z/F5300 Series)	2.00	M43/M44 Waterborne Epoxy	1.50	Super Tough Coat Water-Based Epoxy	2.00	TRU-GLAZE Waterborne Acrylic Epoxy (4418-XXXX)	2.00 - 2.50		

DESCRIPTION			MANUFACTURER											
Type & Surface	Luster	No. of Coats	SHERWIN-WILLIAMS		PRATT & LAMBERT		BENJAMIN MOORE		MARTIN SENOUR		ICI PAINTS			
			Products	Dry Mil Thickness (Per Coat)	Products	Dry Mil Thickness (Per Coat)	Products	Dry Mil Thickness (Per Coat)	Products	Dry Mil Thickness (Per Coat)	Products	Dry Mil Thickness (Per Coat)		
10. Plaster (New)	Acrylic Latex Eggshell	1	PrepRite ProBlock Int/Ext Latex Primer Sealer (B51W20)	1.40	Suprime "12" Interior Alkyd Wall Primer (D/D1012)	1.50	Super Spec Latex En. Under. & Primer Sealer (253)	1.10			PREP & PRIME GRIPPER Multi-Purpose Water-Based Primer Sealer (3210-1200)	1.90		
		2	ProMar 200 Interior Latex Eg-Shel (B20W2200 Series)	1.20	Accolade Interior Velvet (Z/F4000 Series)	1.50	Super Spec Latex Eggshell Finish (274)	1.30	Platnum Interior Eggshell	1.30	ULTRA-HIDE Latex Eggshell Interior Wall & Trim Enamel (1412-XXXX)	1.30		
11. Interior Concrete Masonry Units Walls or Concrete Walls/Ceilings	Acrylic Latex Semi-Gloss	2	PrepRite Block Filler Int/Ext Latex (B25W25)	8.00	Pro-Hide Silver Block Filler (Z8465)	12.00	Super Craft Latex Block Filler (285)	8.10	Pro Line Premium Block Filler	9.00	PREP & PRIME Block Filler Water-Based (3010-1200)	8.00		
		1	ProMar 200 Interior Latex S.G. (B31W2200 Series)	1.50	Accolade Interior Semi-Gloss (Z/F4100 Series)	1.50	Super Spec Latx Semi-Gloss Enamel (276)	1.20	Platnum Interior Satin Gloss	1.30	DULUX ULTRA Semi-Gloss Acrylic Interior Wall & Trim Enamel (1407-XXXX)	1.50		
12. Interior Concrete Masonry Units Walls or Concrete Walls/Ceilings (Except Interior Pools)	Epoxy Eggshell	2	Water Based Catalyzed Epoxy (B70-200 Series)	2.50 - 3.00	Tech-Gard Waterborne Epoxy (Z/F5300 Series)	2.00	M43/M44 Waterborne Epoxy	1.50	Super Tough Coat Water-Based Epoxy	2.00	TRU-GLAZE-WB 4406 Semi-Gloss or 4408 Gloss Waterborne Epoxy	3.0 -5.0		
13. Interior Wood	Acrylic Latex Semi-Gloss	1	PrepRite ProBlock Int/Ext Latex Primer Sealer (B51W20)	1.40	Suprime "1" 100% Acrylic Multi-Purpose Primer (Z1001)	1.25	Fresh Start All Purpose Primer (023)	1.20	TPS Int/Ext Latex Primer	1.20	PREP & PRIME WALL & WOODWORK 100% Acrylic Interior Water-Based Primer Sealer (1020-1200)	1.10		
		2	ProClassic Waterborne Acrylic Semi-Gloss (B31 Series)	1.30	Accolade Interior Semi-Gloss (Z/F4100 Series)	1.50	Waterborne Satin Impervo (314)	1.40	Platnum Interior Satin Gloss	1.30	DULUX ULTRA Semi-Gloss Acrylic Interior Wall & Trim Enamel (1407-XXXX)	1.50		

DESCRIPTION			MANUFACTURER									
Type & Surface	Luster	No. of Coats	SHERWIN-WILLIAMS		PRATT & LAMBERT		BENJAMIN MOORE		MARTIN SENOUR		ICI PAINTS	
			Products	Dry Mil Thickness (Per Coat)	Products	Dry Mil Thickness (Per Coat)	Products	Dry Mil Thickness (Per Coat)	Products	Dry Mil Thickness (Per Coat)	Products	Dry Mil Thickness (Per Coat)
14. Interior Wood	Natural Finish Satin Stain	1	Wood Classics Interior Oil Stain (A48-200 Series)	Nominal	Tonetic Oil Wood Stain	Nominal	Benwood Interior Wood Stain (234)	Nominal	MS Interior Wood Stain	Nominal	WOODPRIDE Interior Wood Finishing Stain (1700-XXXX)	Nominal
		2	Wood Classics Waterbourne Polyurethane Varnish (A68 Series)	1.00	Varmor Clear Urethane Finish (R10,11)	0.75	Benwood Polyurethane Low Luster (C435)	1.00	AstroVar Polyurethane - Satin	1.00	WOODPRIDE Interior Waterborne Aquacrylic Varnish (1802-0000)	1.00
15. Exterior Wood	Acrylic Solid Stain	1	WoodScapes House Stain Exterior Acrylic Solid Color (A15 Series)	1.30	STAINShield Solid Hide Oil Primer (S/D2570)	2.30	Moorwood 100% Acrylic Latex Solid Siding Stain (N089)	Minimal	Great Outdoors Solid Latex Stain	2.00	WOODPRIDE Exterior Waterborne Solid Color Stain (2600-XXXX)	1.30
		1	WoodScapes House Stain Exterior Acrylic Solid Color (A15 Series)	1.30	STAINShield Solid Hide Latex Rustic Stain - 100% Acrylic (Z/F 1300 Series)	2.00	Moorwood 100% Acrylic Latex Solid Siding Stain (N089)	Minimal	Great Outdoors Solid Latex Stain	2.00	WOODPRIDE Exterior Waterborne Solid Color Stain (2600-XXXX)	1.30
16. Exterior Wood	Spar Varnish Natural Stain	1			Tonetic Oil Wood Stain	Nominal			MS Interior Wood Stain	Nominal		
		3	Helmsman Spar Varnish	1.20	Vitralite UVA Spar Varnish (R7)	1.20	Impervo 440 Spar Varnish	1.20	MS Marine Spar Varnish	1.20	Old Masters Spar-Marine Varnish	2.00
17. Exterior Ferrous Metal (Not Galvanized)	Alkyd Gloss or Semi-Gloss	1	Kem Kromik Universal Metal Primer (B50Z Series)	3.00	Suprime "9" Int/Ext Alkyd Metal Primer (Z1009)	1.25	Alkyd Metal Primer (M06)	2.00	Tough Coat Universal Alkyd Primer	1.25	DEVGUARD T&S Multi-Purpose Metal Primer (4160-XXXX)	2.00
		2	Industrial Enamel (B54Z Series)	3.00	Effecto Enamel (S/D1100 Series)	1.25	Rapid Dry Gloss Enamel (CM20)	2.00	Super Tough Coat Alkyd Enamel	1.50	DEVGUARD Alkyd Industrial Gloss Enamel (4308-XXXX)	2.00
18. Exterior Galvanized Ferrous Metal & Ductwork (Galvanized)	Acrylic Gloss Enamel	1	DTM Acrylic Primer / Finish (B66W1)	3.00	Enducryl Acrylic Prime or Finish (Z190)	2.50	Alkyd Metal Primer (M04)	2.50			DEVFLEX DTM Primer & Flat Finish (4020PF)	2.00
		2	DTM Acrylic Gloss Coat (B66-100)	3.00	Enducryl DTM Gloss Acrylic Maintenance Enamel (Z2900 Series)	2.00	DTM Acrylic Gloss Enamel (M28)	2.50			DEVFLEX High Performance Waterborne Acrylic Semi-Gloss Enamel (4216-XXXX)	3.00

**NOTE: Interior face of gypsum board on exterior walls to have low perm (.5) primer**

SECTION 10440

SIGNAGE

Part 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Provide products that meet or exceed the requirements of these specifications as manufactured by Welch Signage *and digital graphics*, 7 Lincoln Avenue, Scarborough, ME 04092. Phone (800) 635-3506 - Fax (800) 225-6859

2.2 SIGNAGE - GENERAL

- A. Provide all interior signage required by code. Provide numbers on all apartment doors. Note: One raised set at 5' 0" off finish floor and one set 18" off finish floor.

2.3 COMPLIANCE

- A. All signs must comply with the Americans with Disabilities Act including all conditions noted and all other requirements.
  - 1. **Sign Finish & Contrast** - The color selected for the character and symbols should be in marked contrast to the sign background. Characters and background must be matte or other non-glare finish.
  - 2. **Tactile & Braille** - Characters must be raised 1/32" and be accompanied by Grade II Braille.
  - 3. **Typestyle** - Characters must be uppercase and San Serif or simple Serif style. Directional and informational signs are allowed to include lower case letters. Characters must have width-to-height ratio of between 3:5 to 1:1. Characters must have a stroke to height ratio of 1:5 to 1:10.
  - 4. **Character Height** - Tactile characters height must be between 5/8" and 2", all caps. Characters on projected or overhead signs must be a minimum of 3" high. Characters on directional signs and informational signs must be sized appropriate to the viewing distance.
  - 5. **Pictograms** - Pictograms shall be accompanied by the equivalent written description placed directly below pictogram and be in a background area of at least 6" x 6".

2.4 SIGN TYPES

- A. Interior Panel Signs - Provide signs having the following characteristics:
  - 1. **Substrate:** Fabricate signs from 1/8 inch thick matte clear acrylic with edges mechanically and smoothly finished to eliminate cut marks. Background color to be subsurface.
  - 2. **Background Color:** Choose from - Colors to be selected by Architect from manufacturer's standards. Or custom color to be selected by Architect
  - 3. **Edges:** Straight
  - 4. **Corners:** Choose from - square or 3/8" radius
  - 5. **Size:** As indicated or if not indicated provide 6" x 6"
  - 6. **Copy:** Helvetica or as shown on drawings
  - 7. **Copy Color:** To be selected by Architect from manufacturer's standards

## 16 Middle Street – Portland, ME

8. **Letterform:** Apply 1/32" computer precision cut tactile copy. All uppercase, normal spacing, 5/8" minimum letter height. Tactile letters will be applied in a manner which avoids scoring of the sign's surface at base of tactile letters.
  9. **Braille:** Use engraved process for all Braille areas. Engrave Braille dots into surface of clear material.
- B. Message Insert Signs - Provide signs having the following characteristics:
1. **Substrate:** Fabricate signs from 1/8 inch thick matte clear acrylic with edges mechanically and smoothly finished to eliminate cut marks. Background color to be subsurface.
  2. **Assembly:** Sandwich two exact sized acrylic pieces with foam tape as dividers. Face plate to have clear windows for message inserts. (See drawings for details.)
  3. **Background Color:** Choose from -  
Colors to be selected by Architect from manufacturer's standards.  
Or custom color to be selected by Architect
  4. **Edges:** Straight
  5. **Corners:** Choose from - square or 3/8" radius
  6. **Size:** As indicated or if not indicated provide 6" x 6"
  7. **Copy:** Helvetica or as shown on drawings
  8. **Copy Color:** To be selected by Architect from manufacturer's standards
  9. **Letterform:** Apply 1/32" computer precision cut tactile copy. All uppercase, normal spacing, 5/8" minimum letter height. Tactile letters will be applied in a manner which avoids scoring of the sign's surface at base of tactile letters.
  10. **Braille:** Use engraved process for all Braille areas. Engraved Braille dots into surface of clear material.



Section 14240  
ELEVATOR

PART 1- GENERAL

1.1 DESCRIPTION

A. Work Included in this Section:

1. Provide all labor and materials required to furnish and install all Elevator Work as indicated on the Drawings, specified herein, or otherwise required for a complete and proper job.
2. All elevators shall be complete and in place, fully operational, tested and approved.
3. Co-ordinate work of other trades to ensure a complete installation

B. Related work specified elsewhere:

1. Section 05500: Miscellaneous metal work
2. Section 06100: Rough carpentry
3. Section 09900: Painting and Wall covering
4. Division 15000: Mechanical
5. Division 16000: Electrical

C. WORK NOT INCLUDED: This specification does not include the following work, and is contingent on the proper performance of such work by the General Contractor or other Subcontractors:

1. A legal hoistway, properly framed, plumb to within 1", and including a pit of proper depth provided with ladder, entrance sill supports, lights, and waterproofing as required.
2. Legal machine room, adequate for elevator equipment, including lighting, ventilation or temperature controls to maintain the room between 60 and 90 degrees F.
3. Adequate supports for guide rail brackets, sufficient to support loads of all equipment.
4. A hoist beam shall be furnished at the top of the hoistway, located on centerline of car and guides - designed to lift load required.
5. Required sleeves in hoistway wall, or any trenching and filling, for oil line and wiring duct for elevator, as shown.
6. Any cutting and patching of building construction required for installing signal fixtures, or other elevator apparatus, and any repairs, grouting, patching, or painting made necessary by same.
7. Barricades as may be required during construction to meet safety requirements.
8. A fused disconnect switch for each elevator, of ample capacity, with wiring to the elevator motor started control. Auxiliary contacts for battery lowering when provided.
9. Suitable 110V service with fused disconnect connected to terminals in elevator controller for car light service with fused disconnect.
10. Heat, and product of combustion sensors with necessary wiring to elevator

control panel as required for Fireman’s Service.

11. Telephone wiring from building source to elevator control panel.
12. Furnishing of any special intercom, paging, or television systems, including wiring from building source to elevator control panel.
13. Necessary power for installing, erecting, and testing without charge.
14. Any features or equipment required, but not specifically specified as being furnished by elevator contractor.
15. A safe and dry space to store elevator equipment and tools before and during construction.
16. Finished floor covering in elevator cab.
17. Locating elevator jack hole. Removal and disposal of drilling spoils. Water, access to pit area for truck mounted drill rig.

## 1.2 QUALITY ASSURANCE

- A. All work shall comply with ASME/ANSI A 17.1 2007, National Electric Code, and all applicable Federal, State, and Local codes, including the New Hampshire Barrier Free Design Code, including all revisions to the date of Contract. If the Contract Documents indicate or imply requirements contrary to applicable codes or regulations, the Architect shall be so advised before fabrication of components is started.
- B. In all cases where a device, or part of the equipment is referred to by a singular number, it is intended that such references shall apply to as many devices as are required to complete the installation.
- C. The elevator subcontractor shall be regularly engaged in the business of installing and servicing elevators of the type specified herein, and shall have a local history of successful installation acceptable to the Architect and the owner.
- D. Controllers and door operators to be non-proprietary requiring no hand held programming or servicing tools.

## 1.3 PERMITS AND INSPECTIONS

- A. The elevator subcontractor shall obtain/furnish all licenses and permits and shall arrange for and make all inspections and tests related to his work.

## 1.4 MAINTENANCE

- A. Provide ONE (1) year Full Maintenance Service commencing on date of final inspection.
  1. Include 24 hour per day, 7 days a week emergency service.
  2. Include periodic preventative maintenance visits.
  3. Maintenance repairs to be performed during normal working hours, Monday thru Friday.
- B. Provide ONE (1) year manufacturer’s full warrantee commencing on date of final inspection. Replacement of worn or defective parts shall result in no cost to owner.

## 1.5 SUBMITTALS

- A. Product Data: within 30 calendar days after award of the Contract, submit:

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1. Complete shop drawings of all work of this section, including electrical requirements, dimensions and locations of all items, and clearances required.
2. Finish samples as required by Architect

### PART 2- PRODUCTS

#### 2.1 GENERAL

- A. Design: Shall be based on the use of non-proprietary elevator systems manufactured by Canton Elevator Inc. or approved equal.
  1. Requests for approval must be submitted Five (5) days prior to bid date and include names and contact information for at least 3 additional elevator companies located within 2 hours of project site who are able to provide service, repairs and parts for the requested manufacturer.
- B. If any special tools, schematics, equipment, laptops or other items are required to maintain the elevator provided, such items must be provided with each unit, to become the property of the owner at completion.
- C. Provide elevators to meet requirements for seismic code.

#### 2.2 ELEVATORS

- A. All Elevators shall be provided in full compliance with the following requirements:
  1. Quantity/Type: (2) Holed hydraulic
  2. Passenger elevator
  3. Capacity: 2500 lbs.
  4. Speed: 125 fpm avg.
  5. Inside car dimensions: 6'-8" wide by 4'-3" deep
  6. Travel/Rise: 52' +/- as indicated on drawings
  7. Operation: Duplex
  8. Power: 208V or 480V 3 phase
  9. Motor starter: Wye-Delta reduced voltage starter
  10. Motor: 40 HP max.
  11. Submersible pump unit
  12. Stops/Openings: 5 front (see drawings)
  13. Hoistway Entrances: 3'-6" x 7'-0" side-slide opening with manufacturer's standard enamel finish
  14. Car and landing sills to be extruded aluminum with mill finish
  15. Full height 2 dimensional infra-red door protection device
  16. Manufacturer's standard door operator and equipment, if programming devices are required, they are to be included and remain the property of the owner upon completion.
  17. Cab: - Flush wood walls with plastic laminate directly applied, stainless steel return and transom , stainless flat bar handrails on side wall, LED lighting above acrylic light diffuser
  18. Car door: #4 Stainless steel finish
  19. Car direction arrows with audible signal located on car, visible from landing with

- doors open
20. Multi-light Car Position Indicator located above car door
  21. Stainless steel certificate frame
  22. ADA Compliant auto-dial phone in C.O.P.
  23. Stainless steel Hall Pushbuttons tactile Braille tags & Fire Service Switches/Indicators and Access key switches where required by code.
  24. Fire Service Phase I & II
  25. Independent Service
  26. Hoistway access with hall key-switches located at both top and bottom landings
  27. Any other operations/features required by code
  28. Sealed PVC jack hole liner with Union Guard corrosion protection filler (No variation allowed)

### PART 3- EXECUTION

#### 3.1 INSPECTION

- A. Prior to proceeding with the Work, subcontractor shall verify all dimensions, and shall examine the areas and conditions under which work of this section will be performed and bring adverse conditions to the attention of the general contractor.

#### 3.2 INSTALLATION

- A. Drill jack holes plumb and of sufficient depth and diameter.
- B. Shaft shall be inspected & measured and any deficiencies affecting the work shall be brought to the attention of the superintendent in a timely manner.
- C. Rails shall be installed, plumbed and pointed in a workmanlike manner.
- D. Elevator jacks shall be installed perfectly plumb, fastened to floor and rails
- E. Entrance frames shall be set in alignment with guide rails
- F. Doors, cab and devices shall be installed in a workmanlike manner to achieve the intent of this section and ensure proper, smooth and reliable operation.
- G. On completion of the work, the contractor shall provide 6 hours of time with their adjustor for pre-inspection testing in conjunction with electrical contractor, alarm company, and/or other trades and will furnish a written punch list to the GC prior to State Inspection.
- H. The subcontractor shall arrange for, pay for and co-ordinate State of N.H. Initial Acceptance Inspection and testing. Any required additional or re-testing due to others, shall be the responsibility of others.
- I. Subcontractor shall instruct owner's personnel in operation, cleaning and trouble call reporting.

END OF SECTION

**SECTION 14413  
FIRE EXTINGUISHER CABINETS**

**PART 1 - GENERAL**

**1.1 DESCRIPTION**

This section covers recessed fire cabinets. Cabinets shall be factory painted Panorama series by JL Industries with frameless acrylic door – or equal. Coordinate size with local fire department. Locations as noted on drawings.

**1.2 RELATED WORK**

- A. Acrylic glazing: Section 08 80 00, GLAZING.

**1.3 SUBMITTALS**

- A. Submit in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.
- B. Manufacturer's Literature and Data: Fire extinguisher cabinet including installation instruction and rough opening required.

**PART 2 - PRODUCTS**

**2.1 FIRE EXTINGUISHER CABINET**

Surface-mounted type (see drawings) with flat trim of size and design shown.

**2.2 FABRICATION**

- A. Form body of cabinet from 0.9 mm (0.0359 inch) thick sheet steel.
- B. Fabricate door and trim from 1.2 mm (0.0478 inch) thick sheet steel with all face joints fully welded and ground smooth.
  - 1. Glaze doors with 6 mm (1/4 inch) thick ASTM D4802, clear acrylic sheet, Category B-1, Finish
  - 2. Design doors to open 180 degrees.
  - 3. Provide continuous hinge, pull handle, and adjustable roller catch.

**2.3 FINISH**

- A. Finish interior of cabinet body with baked-on semigloss white enamel.
- B. Finish door, frame with manufacturer's standard baked-on prime coat suitable for field painting.

**PART 3 - EXECUTION**

- A. Install fire extinguisher cabinets in prepared openings and secure in accordance with manufacturer's instructions. Install where noted on drawings.
- B. Install cabinet so that bottom of cabinet is 975 mm (39 inches) above finished floor.

- - - E N D - - -

SECTION 21 13 13

AUTOMATIC FIRE PROTECTION

PART 1 GENERAL

1.1 DESCRIPTION OF WORK

- A. The work covered by this Section of the specifications includes the furnishing of labor, materials, equipment, transportation, permits, inspections and incidentals and the performing of operations required to design, install and test a pressurized, fully supervised, wet or dry pipe fire protection system for full building protection in accordance with NFPA, IBC, and the Owner's insurance underwriter. Areas subject to freezing shall have a dry pipe system, dry pendent or sidewall heads, or glycol-and-water loop per NFPA.
- B. The building sprinkler system design shall be based on NFPA13 requirements.

1.2 RELATED DOCUMENTS

- A. The drawings and the specifications including Section 23 05 00 "Supplemental Mechanical General Requirements" are hereby made a part of the work of this section.
- B. Drawings and general provisions of Contract including General and Supplementary Conditions and all Division 1 specification sections.
- C. Provision of waste management: Section 01 74 19, Construction Waste Management and Disposal.
- D. Coordinate with Section 01 20 00 Price And Payment Procedures.

1.3 QUALIFICATIONS

- A. The Fire Protection Work shall be performed by a qualified Contractor primarily engaged in the design and installation of Fire Protection Systems. The fire protection system design shall be performed under the direction of, and sealed by, a professional engineer registered in the State of Maine or with NICET Level III (minimum) Certification.
- B. Welding qualifications of individuals installing welded piping shall be certified by the National Certified Welding Bureau for the type(s) of weld(s) proposed for use in piping assembly.

1.4 SUBMITTALS

- A. Items for which the submittal requirements of section 23 05 00, Supplemental Mechanical General Requirements, apply are as Follows:
  - 1. Hydrant flow test.
  - 2. System components.

3. Hydraulic calculations.
4. Piping layout, details and control diagram.
5. Flushing and testing records.
6. Certificate of installation.
7. Copy of Fire Protection Contractors License.
8. Welding certificates of individual welding technicians.
9. Sprinkler heads.
10. Alarm valve(s).
11. Fire department connection(s).
12. Firestopping materials and methods.

Submit hydrant flow test, equipment descriptive data, hydraulic calculations and system layout for review by the Owner's Insurance Underwriter. Submit the system layout to the Architect for review. The Architect's review will be limited to checking for conformance with the design concept of the project and general compliance with the contract documents and will in no way assume liability for review for compliance with codes, standards and laws.

- B. Section 01 33 00 - Submittal Procedures: Submittal procedures.
- C. Product Data: Submit data on product characteristics, performance criteria and limitations.
- D. Manufacturer's Installation Instructions: Submit procedure for preparation and installation.
- E. Manufacturer's Certificate: Certify products meet or exceed specified requirements.

#### 1.5 SPRINKLER COVERAGE

- A. Sprinkler head coverage shall conform with NFPA 13 requirements for the use of the building. Coverage shall be increased accordingly where required by the Authority having jurisdiction.
- B. If the requirements of the inspection agency or the Owner's insuring agent are more rigorous than those stated herein, then the more rigorous requirements shall govern.

### PART 2 PRODUCTS

#### 2.1 SYSTEM COMPONENTS AND HARDWARE

- A. Pipe, Fittings, Joints, Hangers, Valves, Fire Department Connections, Alarms: Conform to NFPA 13, Installation of Sprinkler Systems.
- B. Sprinkler Heads:
  1. Interior Heated Spaces: Conform to NFPA 13, commercial quick response type. Provide semi-recessed type with white finish for acoustical tile ceilings. Sprinkler heads in GWB ceilings shall be "concealed" type. Dry pendent or sidewall heads, where allowed by the Architect, may be standard response type.

## 16 Middle Street – Portland, ME

2. Provide a spare head cabinet with wrenches, the amount of spare heads for each orifice size, finish, temperature classification, pattern and length furnished in the project shall be in accordance with the following schedule:

Sprinkler Heads on Project	Number of Spare heads of each type.
Less than 300	6
300-999	12
1000 or more	24

3. Provide head protection guards where required.
  4. Sprinkler heads in unheated areas shall be dry pendent or sidewall type, or served by a glycol and water loop or separate dry-pipe system.
  5. Sidewall sprinkler heads may be used at the Upper Level only (Second Floor Plan). All other sprinkler heads shall be ceiling mounted.
- C. Fire Department Connection: Provide a 4" Storz connection (as verified with the local fire department) at a location coordinated with the local fire department and the Architect.

### 2.2 WATER SUPPLIES

- A. The sprinkler water service shall be cement-lined ductile iron and conform to the requirements of NFPA 13, Installation of Sprinkler Systems.

### 2.3 DEVICES

- A. Detection devices and associated wiring both within the fire protection system and to the building Fire Alarm System shall be the responsibility of the Sprinkler Contractor.

### 2.4 BACKFLOW PREVENTER

- A. Provide AMES MODEL 2000.

### 2.5 PIPING SYSTEM IDENTIFICATION

- A. Piping system and valve identification and color coding shall be in accordance with ANSI.

## PART 3 EXECUTION

### 3.1 PIPING LAYOUT AND DESIGN

- A. System requirements, installation requirements, design, plans, and calculations: Conform to NFPA 13, Installation of Sprinkler Systems.
- B. Sprinkler piping shall be run concealed above ceilings / soffits in occupied areas. Piping in other areas may be run exposed. Piping shall not be exposed in occupied spaces unless indicated on the drawings.



- C. Pipe penetrations through walls and floors shall be in accordance with Section 23 05 00 - Supplemental Mechanical General Requirements. Traverse points of piping shall be escutcheoned with split chrome floor and ceiling plates and spring anchors, where visible to occupancy. Penetrations through walls shall be sleeved in accordance with Section 23 05 00. Sleeves shall be provided by the Fire Protection Contractor.
- D. Coordinate design and layout with building structure and building systems. The work shown in the contract documents has precedence for space requirements. Work of other trades may be modified or moved only with permission of the trade involved. Costs associated with modifications or relocations shall be the same as for "Substitutions" Section 23 05 00.
- E. The Architect shall review proposed system layout and reserve the right to relocate heads, revise sprinkler head type and location and in general review the final layout for components visible in occupied spaces.

### 3.2 SYSTEM ACCEPTANCE

- A. Approval, flushing, hydrostatic testing, instructions, and certificates of installation: Conform to NFPA 13, Installation of Sprinkler Systems.
- B. Disinfect the water piping in accordance with AWWA C601. Fill the piping systems with solution containing a minimum of 50 parts per million of available chlorine and allow solution to stand for minimum of 24 hours. Repeat disinfection if chlorine residual is less than 10 parts per million after 24 hours. Flush the solution from the systems with clean water until maximum residual chlorine contents is not greater than 0.2 parts per million.
- C. Closing in Work:
  - 1. General: Cover up or enclose work after it has been properly and completely reviewed.
  - 2. No additional cost to the Owner will be allowed for uncovering and recovering, work that is covered or enclosed prior to required review and acceptance.
- D. Cleanup and Corrosion Prevention:
  - 1. Upon completion of the work thoroughly clean and flush piping systems to the sewer with water.
  - 2. Piping and equipment shall be thoroughly cleaned. Dirt, dust, and debris shall be removed and the premises left in a clean and neat condition.
  - 3. Before uncovered piping is permitted to be concealed, corrosion and rust shall be wire brushed and cleaned and in the case of iron products, a coat of approved protective paint applied to these surfaces. When corrosion is from the effects of hot solder paste, the areas shall be cleaned and polished and a wash of bicarbonate of soda and water used to neutralize the acid condition.

## 16 Middle Street – Portland, ME

- E. Instructions: On completion of the project, provide a technician familiar with the system to thoroughly instruct the Owner's representative in the care and operation of the system. The total period of instruction shall not exceed four (4) hours. The time of instruction shall be arranged with the Owner.
- F. Warranty: For a period of one (1) year after completion of the installation repair or replace any defective materials or workmanship. Upon completion of the installation, the system shall be turned over to the Owner fully inspected and tested, and in operational condition.

### 3.3 FIRESTOPPING

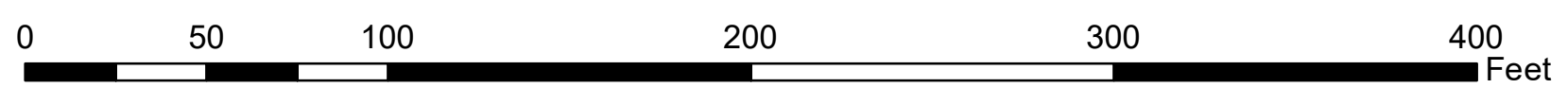
- A. Firestopping shall be performed in accordance with Specification Section 07 84 00 "Firestopping". All penetrations of fire-rated assemblies including walls and floors by mechanical system components (piping, ductwork, conduits, etc.) shall be firestopped as specified.

\* END OF SECTION \*






SR #: 300594



1 inch = 50 feet

Pressure Zone: 267

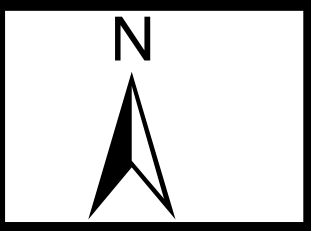


**PORTLAND WATER DISTRICT**  
 225 Douglass Street  
 Portland, ME 04104  
 Asset Management and Planning Dept.

Legend			
● Air Valve	● Connection	⊕ Combined Service	● Manhole
● Blow Off	● Attribute Change	⊕ Domestic Service	● CSO
⊕ By Pass	▲ Reducer	⊕ Fire Service	→ Gravity
⊕ Distribution	● Hydrant	● Private Hydrants	→ Force
⊕ Transmission	● Hydrant Control	⊕ Meter Pits	→ Contours

## Hydrant Flow Testing Data

16 Middle Street  
 Portland



This map depicts flow testing and static pressure data for the selected hydrants from PWD's asset management system. If the data is out of date or insufficient for your needs, please contact the MEANS group to request a hydrant flow test and we will work with you to get more complete data.

Drawn By: HAS  
 Scale: As Noted

Prepared For: Steve Bushey  
 Stantec  
 Date: May 26, 2016



SECTION 22 00 00

PLUMBING

PART 1 GENERAL

1.1 RELATED DOCUMENTS

- A. The drawings and the specifications including Section 23 05 00 "Supplemental General Mechanical Conditions" are hereby made a part of the work of this section.
- B. Drawings and general provisions of the Contract including General and Supplementary Conditions and all Division 1 specification sections.
- C. Provision of waste management: Section 01 74 19, Construction Waste Management and Disposal.
- D. Uniform Federal Accessibility Standards (UFAS).
- E. Americans with Disabilities Act (ADA).
- F. Coordinate with Section 01 20 00 Price And Payment Procedures.

1.2 DESCRIPTION

- A. The work covered by this Section of the specifications includes the furnishing of labor, materials, equipment, transportation, permits, inspections, and incidentals and the performing of operations required to provide a complete and functional plumbing system.
- B. Work shall be in accordance with the current edition of the Maine State Plumbing Code and applicable local ordinances.

1.3 SUBMITTALS

- A. Substitutions: Your attention is directed to Section 23 05 00-"Substitutions", relative to competition and the (ONLY) notation. Familiarity with this section shall be achieved before reading the PRODUCTS section of this specification.
- B. The items for which the submittals paragraph in Section 23 05 00, Supplemental General Mechanical Requirements, apply are as follows:
  - 1. Piping materials.
  - 2. Valves.
  - 3. Pipe hangers.
  - 4. Fixtures and trim.
  - 5. Miscellaneous equipment.
  - 6. Water heating equipment.

7. Piping, valves and equipment identification.
  8. Firestopping.
  9. Electronic trap primers.
  10. Elevator pit drainage system.
  11. Thermostatic mixing valve (TMV).
  12. Temperature limiting mixing valves.
  13. Rainwater filters.
  14. Grease Interceptor.
- C. Section 01 33 00 - Submittal Procedures: Submittal procedures.
- D. Product Data: Submit data on product characteristics, performance criteria and limitations.
- E. Manufacturer's Installation Instructions: Submit procedure for preparation and installation.
- F. Manufacturer's Certificate: Certify products meet or exceed specified requirements.

## PART 2 PRODUCTS

### 2.1 PIPING MATERIALS

- A. Soil and Waste (Sanitary) and Vent Piping, Roof Drain Piping:
1. Below Grade: Schedule 40 PVC with solvent-welded joints.
  2. Above Grade: Schedule 40 PVC with solvent-welded joints. Vent piping shall be Schedule 40 PVC.
- B. Domestic Water Piping:
1. Pipe sizes larger than 1": Type L hard copper tubing and cast bronze or wrought copper solder fittings with lead-free soldered joints. All below slab water piping shall be cement-lined ductile iron.
  2. Pipe sizes 1" and smaller:
    - a. Uponor AquaPEX, NSF rated, 180°F at 100psi, red (HW), blue (CW) and white (RHW).
    - b. "Flowguard Gold" Schedule 40 solvent-welded CPVC pipe and fittings. CPVC pipe and fittings shall be rated at 100 psig at 180°F and shall meet or exceed the requirements of ASTM D2846, the IBC, and be certified by the ANSI/NSF for potable water applications. Installation, including supports, shall be per the manufacturer's recommendations.
- C. Exposed Water and Waste Piping at Fixtures: I.P.S. copper with cast brass fittings chrome plated finish, with deep one piece escutcheon plates at traverse points.
- D. Solder: Lead-free (ONLY), Englehard Silvabrite 100, 440°F melting point, ASTM B32.

- E. Sprinkler Service Entrance Piping (to 10 ft outside of building and below slab): Cement-lined ductile iron, coordinate with Section 211313 - Automatic Fire Protection.

## 2.2 GAS PIPING SYSTEM

- A. Gas Piping: Schedule 40 carbon steel pipe conforming to ASTM 120 or A53, with threaded joints and malleable iron fittings (Above grade). Exterior gas piping shall be painted (yellow) with two (2) coats of rust-inhibiting enamel.
- B. Ball Valves for Gas Service: Copper alloy with chromium plated floating ball per Federal Specification WW-V-35B, Type II, Class 3. Blowout-proof stem, reinforced teflon seats, threaded ends, quarter turn on-off, 600 WOG rating, 250 psi rating for natural gas, UL-listed as a natural gas shutoff valve, Apollo Model 80-100 series.

## 2.3 NO HUB COUPLINGS

- A. For DWV piping, couplings shall be Clamp-All HI-TORQ125, shall maintain 15 PSI hydrostatic seal, constructed 304SS housing and ASTM C-564 neoprene gasket. Couplings shall meet FM 1680, IBC and local codes and requirements.

## 2.4 VALVES

- A. Ball Valves: Copper alloy with stationary seat ring and chromium plated or stainless steel floating ball per Federal Specification WW-V-35B. Blowout proof stem, reinforced PTFE seal. Sizes 2" and larger shall have threaded ends. Provide lever handle with stem extension as required to allow operation without interfering with pipe insulation.
- B. Check Valves: Horizontal Swing, MSS SP-80, Type 3, Class 125.
- C. Drain Valves: Provide ball valves with 3/4" hose connection and brass cap.
- D. Fixture Service Stop Valves: Angle Wheel Handle Stop, ASME A112.18M.
  - 1. Each plumbing fixture shall have individual stop valves in the hot and cold supplies.
  - 2. Service stop valves exposed in finished areas shall be chrome-plated brass; in non-finished areas, ball valves shall be used in lieu of chromed supplies.
- E. Temperature and Pressure Relief Valves: Bronze body, tested under ANSI Z21.22, AGA and ASME rated, 125 psig/210°F relief settings.

## 2.5 PIPE HANGERS

- A. Adjustable Swivel Hangers:
  - 1. Pipe sizes 2" and less: Carpenter and Paterson Fig. 800, oversize for insulated piping systems.

2. Pipe sizes larger than 2": Carpenter and Paterson Fig. 100, oversize for insulated piping systems.
- B. Riser Clamp: Carpenter and Paterson Fig. 126 CT copper plated for copper piping, Fig. 126 for iron and PVC piping.
- C. Insulation Shields: 18 ga. galvanized steel, 180° wrap, Carpenter and Paterson Fig. 265P, Type H.

## 2.6 FIXTURES AND TRIM

- A. (P-1) ADA/UFAS Water Closet: Floor-mounted, tank type, Toto Eco-Drake CST744E, American-Standard, Zurn, or approved equal, elongated bowl, white vitreous china, 17" high, low consumption (1.28 gpf). Color matched trip lever shall be mounted on the wide side of the stall. Fixture shall be suitable for 12" rough-in.
  1. Seat: Toto Model SC134, heavy weight solid plastic, open-front without cover, self sustaining check hinge, for elongated bowl, white color.
  2. Total installed height of front edge of seat shall be 17" to 19" above finished floor. Final installation shall meet ADA/UFAS guidelines and ANSI A117.1.
- B. (P-2A) ADA/UFAS Lavatory, Wall Hung: Toto LT307.4, Zurn, or approved equal, 20"x18", self-rimming, white vitreous china, faucet holes on 4" centers.
  1. Faucet: Symmons Symmetrix Model S-20-2-FR single handle, 0.5 GPM flow aerator, polished chrome finish, ceramic control cartridge.
  2. Drain: Perforated grid strainer with bright metal finish.
  3. Trap: 1-1/4" PVC P-trap with cleanout plug. Adjustable with connected elbow and nipple to wall.
  4. Lavatory shall be installed at 34" above finished floor (See Architectural drawings). Final installation of lavatory and accessories shall meet ADA guidelines and ANSI A117.1. Insulate exposed traps and supplies with Truebro Lavguard. Note that this insulation requirement applies to piping under "removable" cabinets as well.
- C. (P-4A) ADA/UFAS Kitchen Sink, Single Bowl: Elkay LRAD2521, Just, or approved equal, stainless steel, 25"x21.25" overall size, 6" deep, 4 faucet holes on 4" centers, fully sound deadened.
  1. Faucet: Symmons Symmetrix Model S-23-2-10, Moen Commercial, or approved equal, wrist operation handle, 10-7/8" swing spout, polished chrome finish, side spray, ceramic control cartridge, single lever with pull-out side spray.
  2. Strainer: Removable basket and neoprene stopper.

3. Sink installation shall be in compliance with the ADA guidelines.
  4. Exposed traps and supplies with Truebro Lavguard. Note that this insulation requirement applies to “removable” cabinets, as well.
- D. Provide stops on hot and cold water supplies to each fixture with key operators. Provide chrome-plated P-traps per Code.

## 2.7 MISCELLANEOUS EQUIPMENT

- A. Floor Drains (FD) / Roof Drains (RD): Floor drains shall be Zurn Z-415, Watts, or approved equal, cast iron body with 2" or 3" bottom outlet, as indicated, combination invertible membrane clamp and adjustable collar. Strainer shall be 6" diameter Zurn "Type B", polished nickel-bronze. Floor drains shall have “deep seal” traps and trap primer connection, connect to nearest plumbing fixture or electronic trap primer. Roof drains shall be Zurn Z-164ERC, or equal, combination main roof and overflow drains with extension, galvanized steel strainers, sump and clamp. Downspout nozzles shall be Zurn Model Z199, polished bronze with strainer.
- B. Floor/Yard Cleanout (FCO/YCO): Zurn Z-1400 Watts, or approved equal, adjustable floor cleanout, cast iron body, with gas and watertight ABS tapered thread plug. Provide size equal to piping served with maximum size of 4".
1. Concrete floor finishes: Scoriated round polished bronze top.
  2. Sheet tile finishes: Scoriated square polished bronze top recessed to receive tile.
  3. Carpeted finishes: Scoriated round polished bronze top and carpet marker.
- C. Wall Cleanout (WCO): Sanitary tee with threaded raised nut or countersunk-nut cleanout plug located behind Zurn Z-1468, Watts, or approved equal, round stainless steel wall access cover.
- D. Vacuum Breaker: Watts Model N36, 3/4" size, 20 CFM capacity.
- E. Strainer: Watts Series 777, MIL-S-16293, bronze body wye-type, 200 WOG rating, screwed end connections, 20 mesh stainless steel, monel, or bronze screen.
- F. Freezeless Wall Hydrant: Woodford Model 25, Zurn, or approved equal, 3/4" size, brass body, brass head nut, automatic draining, with vacuum breaker.
- G. Water Hammer Arrestor (Shock Absorber): Plumbing and Drainage Institute listed.

Schedule:

"A" - Size #100 PDI - 0-11 Fixture Units

"B" - Size #200 PDI - 12-32 Fixture Units



"C" - Size #300 PDI - 33-60 Fixture Units

- H. Vacuum Breaker: Watts Model N36, 3/4" size, 15 CFM capacity.
- I. Electronic Trap Primer (**ETP**): PPP Inc. PT-series, Zurn, or approved equal, 120V., atmospheric vacuum breaker, pre-set 24 hour clock, manual over-ride switch, shut-off valve, water hammer arrestor, calibrated manifold. Individually pipe to floor drain traps.
- J. Water Meter: Coordinate with the Kittery Water District and include the cost of the meter and installation per the Water District requirements.
- K. Backflow Preventers (BFP): Conforming to AWWA C506, FCCHR-USC Manual Section 10, and UL listed. Types, sizes and capacities scheduled, Apollo, Zurn or Watts.
  - 1. Double Check (DC): Double check backflow assembly with test ports, bronze body with stainless steel springs, corrosion resistant internals, stop and waste ball valves.
  - 2. Atmospheric Double Check (DCA): Double check continuous pressure type with atmospheric port for low hazard applications, 250°F maximum water temperature, bronze body, stainless steel internals with rubber seals and integral strainer.
  - 3. Reduced Pressure Zone (RPZ): Reduced pressure principle type; bronze body with stainless steel internals. Provide bronze body ball valves, test cocks, and air gap fittings.

## 2.8 WATER HEATING EQUIPMENT (**GWH-1, 2**)

- A. Natural Gas-Fired Water Heaters (**GWH-1, 2**): Bradford-White, AO Smith, State Industries or approved equal packaged unit of make, model, and performance as scheduled on Drawings; UL 732 and ASHRAE 90.1 compliant, ASME Section IV code construction, designed to burn natural gas, glass-lined or other approved lined tank with replaceable magnesium anode rods and heavy gauge steel jacket with baked enamel finish, factory installed ASME rated temperature and pressure relief valve, dial thermometer and pressure gauges and adjustable range thermostat with digital display. Set to provide 140°F water temperature. Hot and cold water connections shall be 1½". The water heater shall be high efficiency, direct vent, sealed combustion.
  - 1. Burner controls: modulating burner, solid state flame safeguard with direct spark ignition, electronic low-water cut-off, and separate high temperature limit control.
  - 2. The water heaters shall have a three (3) year free replacement warranty in commercial service for labor and materials. The pressure vessel and combustion chamber shall have a five (5) year warranty for materials and labor. Furnish with concentric sidewall or roof vent kit as indicated. Furnish with condensate neutralization kit.
  - 3. Installation shall be in accordance with the manufacturer's recommendations. Venting shall be Type AL29-4C stainless steel, Schedule 40 CPVC or polypropylene per the installation instructions.

2.9 THERMOSTATIC MIXING VALVE / TEMPERATURE LIMITING VALVE

- A. Thermostatic Mixing Valve (**TMV**): Heat-Timer, Leonard, Symmons, or approved equal packaged unit of make, model, and performance as specified, complying with ASSE 1017 or CSA B125.3. Furnish with integral check-stops and thermometer.
- B. Temperature Limiting Valves (**TLV**): Watts, Fiat, or approved equal, with make, model and performance as specified, complying with ASSE 1070 or CSA B125.3. Furnish with integral check-stops.

2.10 RAINWATER FILTERS

- A. BioClean Downspout Filter, or equal, installed per the manufacturers recommendations, installed at each roof drain leader. Internal components shall be constructed of stainless steel. Provide service access as recommended by the manufacturer.

2.11 GREASE INTERCEPTOR

- A. Canplas Model XL100, or equal, polyethylene construction, 200 lb. grease capacity, 4" inlet and outlet, dual access covers. The unit shall be PDI G101 approved, NSF and IAPMO listed and approved by the City of Portland.

PART 3 EXECUTION

3.1 SURFACE CONDITIONS

- A. Inspection:
  - 1. Prior to work of this Section, carefully inspect the installed work of other trades and verify that such work is complete to the point where this installation may properly commence.
  - 2. Verify that plumbing may be installed in strict accordance with pertinent codes and regulations and the reviewed Shop Drawings.

3.2 INSTALLATION OF PIPING

- A. Provide and erect in accordance with the best practice of the trade piping shown on the drawings and as required to complete the intended installation. Make offsets as shown or required to place piping in proper position to avoid other work and to allow the application of insulation and finish painting to the satisfaction of the Architect.
- B. The size and general arrangements, as well as the methods of connecting piping, valves, and equipment, shall be as indicated, or so as to meet the requirements of the Architect.
- C. Piping shall be erected so as to provide for the easy and noiseless passage of fluids under working conditions.

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- D. Install unions to facilitate removal of equipment.
- E. Copper pipe shall be reamed to remove burrs.
- F. Connections between copper and steel piping shall be made with dielectric fittings.
- G. Solder joints shall be made with lead free solder. Clean surfaces to be soldered and use a paste flux. Wash joints with sodium bicarbonate and water to remove corrosive effects of heated solder paste. Caution: Lead-bearing solder is not permitted.
- H. Pipe penetrations through walls, floors and ceilings shall be in accordance with Section 23 05 00 "Supplemental General Mechanical Requirements". Traverse points of piping shall be escutcheoned with split chrome floor and ceiling plates and spring anchors, where visible to occupancy.
- I. Provide a cleanout in the vertical position at the base of each sanitary drop.
- J. Sanitary and vent piping shall be sized and installed at 1/4" per foot slope.
- K. All vertical and horizontal penetrations through walls, floors and ceilings shall be sealed against air movement between spaces.

**3.3 PIPE HANGERS**

- A. Impact driven studs are prohibited.
- B. Copper Tubing: supported at intervals with rod sizes as follows, double nuts on hangers and on beam clips.

Copper Size	Hanger Intervals	Rod Sizes
1/2"	5'	3/8"
3/4"	6'	3/8"
1"	6'	3/8"
1-1/4"	8'	3/8"
1-1/2"	8'	3/8"
2"	10'	3/8"

- C. Cast Iron Pipe: Supported at intervals with rod sizes as follows, double nuts on hangers and on beam clips.

Cast Iron Size	Hanger Intervals	Rod Sizes
1-1/2"	5'	3/8"
2"	5'	3/8"
2-1/2"	5'	1/2"
3"	6'	1/2"
4"	7'	5/8"

- D. PVC/CPVC Pipe: Supported at 4 foot intervals.

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- E. Verticals: Supported by use of clamp hangers at every story height, and at not more than 6 feet intervals for copper piping 1-1/4" and smaller size.
- F. Spring Isolators: All pipe 20' upstream and downstream of pumps.

### 3.4 CLOSING IN UNINSPECTED WORK

- A. General: Cover up or enclose work after it has been properly and completely reviewed.
- B. If any of the work is covered or enclosed prior to required inspections and review, uncover the work as required for the test and review. After review, tests and acceptance, repairs and replacements shall be made by the appropriate trades with such materials as necessary for the acceptance by the Architect and at no additional cost to the Owner.

### 3.5 CLEANUP AND CORROSION PREVENTION

- A. Upon completion of the work thoroughly clean and flush piping systems to the sewer with water.
- B. Fixtures, piping and equipment shall be thoroughly cleaned. Dirt, dust, and debris shall be removed and the premises left in a clean and neat condition.
- C. Caulk around fixtures at floor and wall.
- D. Before covering is applied to piping systems, clips, rods, clevises and other hanger attachments, and before uncovered piping is permitted to be concealed, corrosion and rust shall be wire brushed and cleaned and in the case of iron products, a coat of approved protective paint applied to these surfaces. When corrosion is from the effects of hot solder paste, the areas shall be cleaned and polished and a wash of bicarbonate of soda and water used to neutralize the acid condition.

### 3.6 DISINFECTING

- A. After the entire potable water system is completed, cleaned and tested, and just before the building is ready to be occupied, disinfect the system as follows: After flushing the mains, introduce a water and chlorine solution for a period of not less than three hours before final flushing of the system.

### 3.7 TESTS

- A. Sanitary soil, waste and vent piping: Fill with water to top of vents, and test as required by Code.
- B. Water piping shall be tested to a pressure of 100 lbs. per square inch for at least 30 minutes. Pressure drop in this period shall not exceed two pounds per square inch. Leaks shall be repaired and system retested. Notify Architect 24 hours before test is to be performed.

**3.8 INSTRUCTIONS**

- A. On completion of the project, provide a competent technician to thoroughly instruct the Owner's representative in the care and operation of the system. The total period of instruction shall not exceed four (4) hours. The time of instruction shall be arranged with the Owner.

3.9 FIRESTOPPING

- A. Firestopping shall be performed in accordance with Specification Section 07 84 00 “Firestopping”. All penetrations of fire-rated assemblies including walls and floors by mechanical system components (piping, ductwork, conduits, etc.) shall be firestopped as specified.

\* END OF SECTION \*

SECTION 23 00 00

HVAC SYSTEM

PART 1 GENERAL

1.1 DESCRIPTION

- A. The work covered by this Section of the specifications includes the furnishing of labor, materials, equipment, transportation, permits, inspections and incidentals and the performing of operations required to install the heating, ventilating and air conditioning systems indicated.

1.2 RELATED DOCUMENTS

- A. The drawings and the specifications including Section 23 05 00 "Supplemental Mechanical General Requirements" are hereby made a part of the work of this section.
- B. Drawings and general provisions of Contract including General and Supplementary Conditions and all Division 1 specification sections.
- C. Provision of waste management: Section 01 74 19, Construction Waste Management and Disposal.
- D. Coordinate with Section 01 20 00 Price And Payment Procedures.

1.3 SUBMITTALS

- A. Substitutions: Your attention is directed to Section 23 05 00-"Substitutions", relative to competition and the (ONLY) notation. Familiarity with this section should be achieved before reading the PRODUCTS section of this specification.
- B. The items for which the submittals paragraph in Section 23 05 00, Supplemental Mechanical General Requirements, apply are as follows:
  - 1. Fans.
  - 2. Valves and Piping.
  - 3. Heating and cooling equipment.
  - 4. Minisplit Air Conditioning Units.
  - 5. Gas-Fired Rooftop Units w/ Packaged DX Cooling.
- C. Section 01 33 00 - Submittal Procedures: Submittal procedures.
- D. Product Data: Submit data on product characteristics, performance criteria and limitations.
- E. Manufacturer's Installation Instructions: Submit procedure for preparation and installation.

- F. Manufacturer's Certificate: Certify products meet or exceed specified requirements.

## PART 2 PRODUCTS

### 2.1 PIPING MATERIALS AND ACCESSORIES

- A. Condensate Piping: Type L hard copper tubing and cast bronze or wrought copper solder or Victaulic "Permalynx" fittings or Schedule 40 CPVC (solvent-welded).
- B. Watertight Roof Penetrations: Piping penetrations thru the roof shall be made watertight with a curbed opening by Portals Plus or ConnFab.

### 2.2 HANGERS

- A. Adjustable Swivel Hanger: Pipe Sizes 2" and Less: Carpenter and Paterson Fig. 800 conforming to MSS-SP-58, oversize for insulated piping systems. Pipe Sizes Larger Than 2": Carpenter and Paterson Fig. 100, oversize for insulated piping systems.
- B. Riser Clamp: Carpenter and Paterson Fig. 126 and Fig. 126 CT conforming to MSS-SP-58, provide copper plated clamps on copper pipes.
- C. Spring Vibration Isolation Pipe Hangers: Mason Industries Model PC30N, or approved equal by Amber-Booth or Vibration Mountings and Controls, combination spring and double deflection bridge-bearing neoprene hangers, 1" static deflection.

### 2.3 VALVES

- A. Ball Valves: Victaulic PL-300 (push-to-connect) and Series 589/569 (Vic-Press), Apollo 70-100 Series (threaded) or 77-200 (solder), bronze, brass or stainless steel body, full port, Fed. Spec. WW-V-35, Type II, Class A (bronze), Style 3, blow-out proof stem, 300 pound W.O.G., screwed connection for steel pipe, Vic-Press connection for stainless steel pipe, sweat or push-to-connect connection for copper tube. Provide stem extension to allow operation without interfering with pipe insulation. Provide Tee handles for valves thru 2" pipe size.
- B. Gate Valves: Nibco Model S-113 or T-113, bronze body Fed. Spec. WW-V-54, wedge disc, rising stem, screwed connection for steel pipe, sweat connection for copper tube, 150-pound class.
- C. Outside Screw and Yoke (OS&Y) Gate Valves: Nibco Model F-617-0, iron body, Fed. Spec. WW-V-58 with bronze trim, 125 pound class.
- D. Check Valves: Victaulic Style 716 / W715 grooved end spring actuated type, Nibco Model S-413 or T-413, bronze body Fed. Spec. WW-V-51, regrinding swing check type, 200 pound class.
- E. Butterfly Valves: Victaulic MasterSeal and AGS-Vic300, Centerline or Norris, valves shall conform with MSS-SP67, Type I 150 psig (minimum) - Tight shut off valve, ends shall be flangeless or grooved, ductile iron or cast iron body, type 300 series corrosion resistant steel stems and corrosion resistant stainless steel, aluminum – bronze, or coated ductile discs with molded elastomer disc seals / pressure-responsive seats. (Stems shall be offset from the disc centerline to provide full 360 degree circumferential seating). Valves shall have throttling



handles with a minimum of 7 locking positions. Valves shall be suitable for water temperatures up to 250 degrees F. for sizes through 12", and 230 degrees F. for 14" and larger.

2.5 PIPING, VALVE AND EQUIPMENT IDENTIFICATION

- A. Pipe Identification: Provide plastic "wrap around" identification markers by Seton or Setmark indicating flow direction and fluid flowing for the following:

Refrigerant piping

1. Markers shall be placed 30-50 ft. apart for piping in accessible areas.
2. Markers shall be placed outside the pipe insulation and in the most obvious location for viewing. Markers shall not be installed in exposed areas except in the mechanical rooms.
3. Piping identification shall be color-coded and in accordance with ANSI.

- B. Equipment Identification:

1. Provide laminated plastic nameplates for boilers, pumps, and air handling units. Laminated plastic shall be 0.125-inch thick melamine plastic conforming to Fed. Spec. L-P-387, black with white center core. Surface shall be a matte finish, corners shall be square. Accurately align lettering and engrave into the white core. Minimum size of nameplates shall be 1.0 inch by 2.5 inches. Lettering shall be minimum of 0.25-inch high normal block lettering.

- C. Valve Tags:

1. Attach to each valve a 1-1/2" round or octagonal brass tag with 1/2" indented numerals filled with a durable black compound. In addition to the valve numbers, each tag shall identify the system it controls. Service stop valves exposed in finished areas need not be tagged.
2. Tags shall be securely attached to stems of valves with copper or brass "S" hooks, or chains.
3. Valve charts shall be provided for each piping system and shall consist of schematic drawings of piping layouts, showing and identifying each valve and describing its function. Upon completion of the work, one (1) copy of each chart, sealed to rigid backboard with clear lacquer placed under glass and framed, shall be hung where directed. Two (2) additional unmounted copies shall be delivered to the Architect.
4. Tags and charts shall be coordinated with Section 22 00 00 Plumbing and when completed this work shall have been done sequentially.

2.6 FANS

- A. Shall be model indicated. Fan manufacturers shall be Greenheck, Cook or equal. The fans shall include housing, fan wheel, shaft, bearings, inlet shroud, motor, mounting support and mounting frame as a factory-assembled unit. An OSHA-approved belt guard for each fan shall be included. The fan drive shall have a 1.5 service factor for the maximum rated horsepower. Provide a disconnect switch for each fan. Roof and sidewall fans shall have a factory-applied epoxy coating with color selection by the Architect. Provide gravity-operated, gasketed backdraft dampers for all exhaust fans. Bathroom exhaust fans be Panasonic “Whispergreen” Lite, or equal, and shall have a ceiling fire damper, LED light and be controlled from the light switch.
- B. Bearings shall be precision, flange-mounted self-aligning ball bearings at inlet and discharge. Minimum average L50 design life shall be 200,000 hours at maximum catalogued operating conditions. Grease lines shall extend to the exterior of the fan housing.
- C. Submit sound power data for inlet and discharge sound.
- D. Submit fan curves for each fan with the design operating point clearly marked.
- E. Spring Type Vibration Isolators: Mason Industries Model HS, select for 1.5" static deflection. Provide for all fans that are not curb-mounted.
- F. Roof fans and duct penetrations thru the roof shall have 18" high insulated pre-fabricated and self-flashing insulated curbs by Conn-Fab, or approved equal. Provide a suitable foam gasket between the curb and fan base to seal airtight. Single phase fan motors shall be ECM-type, where available, Greenheck “Vari-Green” or equal. Three-phase motors shall be premium, high efficiency type.

## 2.7 PACKAGED ROOFTOP AIR CONDITIONING EQUIPMENT

- A. Provide high efficiency packaged gas-electric air conditioning units and coils of manufacturer, model and performance indicated (**Appendix A**), Lennox, Trane “Precedent”, York, McQuay, Carrier or approved equal. The units shall be a convertible arrangement, suitable for vertical or horizontal duct connections. Furnish with Thycurb, or equal, gas vent extension kits for all units.
- B. The air conditioning units shall consist of a fan section, gas burners, coil sections, coils, and filter/mixing box section with economizer dampers and barometric relief or powered exhaust as scheduled on drawings. Performance shall be ARI 430 certified. Provide access doors in each section. Furnish with roof curbs, packaged controls and high static pressure drive. Provide with through the base electrical connections. Furnish with unit-mounted disconnect.
- C. Cabinet Construction: Steel reinforced and braced with steel angle framework, factory-assembled, sectionalized fan and coil sections, removable access panels to internal parts. Metal parts galvanized steel or chemically cleaned, phosphatized, primed and finished with enamel topcoat.
- D. Fans: Shall be as scheduled, multiblade centrifugal type, statically and dynamically balanced and tested. Bearings shall be self-aligning, grease lubricated ball type. Fan

motor shall be 1800 RPM, open drip-proof or TEFC type, with greasable ball bearings, variable pitch sheave and mounted on an adjustable base. Provide extended grease lines. The fan drive shall have a 1.5 service factor for the maximum rated horsepower. Motors shall be premium high efficiency with minimum motor efficiency conforming to Section 23 05 00 "Electric Motors and Motor Controls". Submit certificate of conformance for motor efficiency.

- E. Coils: Capacities and pressure drops shall be rated in accordance with ARI 410. Coils shall be pressure tested at 300 psig and shall be suitable for 150 psig service.
  - 1. Coils: Copper tubes, aluminum fins and copper headers. Casings shall be 16 gage galvanized steel.
- F. Mixing box section: Outside air and return air dampers shall be "low leak" type. Blade seals shall be neoprene and jamb seals shall be compressible aluminum or stainless steel.
- G. Filters: Provide MERV8 pleated media, CamFarr, or approved equal, 30-35% efficient. Furnish with one (1) initial and two (2) spare sets. Efficiencies shall be as tested in accordance with ASHRAE Standard 52-76.
- H. Submit fan curves for each fan with the design operating point clearly marked.
- I. The compressors shall be direct-drive, scroll or reciprocating hermetic type. Units with two (2) compressors shall have two (2) independent refrigeration circuits. Provide with a five (5) year warranty for parts and labor. Motors shall be suction gas cooled with crankcase heater, low pressure switches, internal temperature and current sensitive motor overloads. Provide with an anti-recycle timer.
- J. The air-cooled condenser shall be of a copper tube and aluminum finned heat exchanger and direct-drive, dynamically and statically balanced fans with permanently lubricated motors and built-in thermal overload protection.
- K. The units shall be provided with packaged controls to meet the specified sequence of operation. Controls shall include all safety devices, damper actuators, CO2 sensor in the return air, "comparative enthalpy" economizer and interlocks, with an interface for the Building Automation System to start/stop the unit, open/close the economizer damper, control the gas furnace / DX cooling and shut down on freeze protection. Coordinate with the BAS and provide a LonWorks card for interface with the BAS.

## 2.8 WALL HEATERS (WH)

- A. Wall heaters (**WH**) shall be Qmark, or equal, electric heating with capacities as scheduled, with integral thermostat.

## PART 3 EXECUTION

### 3.1 SURFACE CONDITIONS

- A. Inspection:
  - 1. Prior to work of this Section, carefully inspect the installed work of other trades and verify that such work is complete to the point where this installation may properly commence.
  - 2. Verify that the heating system may be installed in accordance with pertinent codes and regulations and the reviewed Submittals.

### 3.2 INSTALLATION OF PIPING

- A. In general, piping shall be run concealed above ceilings in occupied areas. Piping in other areas may be run exposed. Piping shall not be exposed in occupied spaces unless written authorization is given by the Architect.
- B. Provide and erect in accordance with the best practice of the trade piping shown on the Drawings and as required to complete the intended installation. Make offsets as shown or required to place piping in proper position to avoid other work and to allow the application of insulation and finish painting to the satisfaction of the Architect.
- C. The size and general arrangements, as well as the methods of connecting piping, valves, and equipment, shall be as indicated, or so as to meet the requirements of the Architect.
- D. Piping shall be erected so as to provide for the easy and noiseless passage of heating fluid under working conditions. Inverted eccentric reducing fittings shall be used whenever water pipes reduce in size.
- E. Water mains shall be run level or pitch slightly upward so that no air pockets are formed in the piping. The mains shall be set at elevations such that the runouts feeding equipment shall have no pockets where air can collect except where vents are provided. Provide drains at low points in the piping systems.
- F. High points in water piping shall be provided with manual vents.
- G. In the erection of water piping, make proper allowances for expansion and contraction. Piping shall be anchored as necessary to control expansion. Hot water runouts to units shall be the size as indicated on the Drawings and shall come off the main downward or off the side with a minimum of two 90° elbows provided on runout from main.
- H. Install stop valves and unions to facilitate isolation and removal of equipment. Provide final connections for hydronic specialties furnished under other sections of the Specifications.
- I. Steel piping with screwed connections. Threads on piping shall be full length and clean-cut with inside edges reamed smooth to the full inside bore. Close nipples shall not be used. Pipe threads: standard pipe threads, machine cut and full length. Pipe: reamed to remove burrs and up-ended and rapped to dislodge dirt and scale. Joint compound shall be applied to male thread only. If it is necessary to back off a screwed joint after it is made, the thread shall be cleaned and new compound applied. Caulked threads will not be permitted.

- J. Connections between copper and steel piping shall be made with bronze fittings.
- K. Install thermometer wells for temperature gauges and sensors, projecting a minimum of 2" into the pipe with extension to face of insulation. Piping 1-1/2" and smaller shall be enlarged to 2" where wells are installed. Wells shall be installed in active sections of piping. Fill wells with heat transfer fluid.
- L. Solder joints shall be made with non-lead solder. Clean surfaces to be soldered and use a paste flux. Wash joints with sodium bicarbonate and water to remove corrosive effects of heated solder paste. Hot wipe solder at each fitting.
- M. PVC piping shall have solvent welded joints except at connections to equipment and valves which shall be screwed for sizes 2" and smaller and flanged for sizes 2-1/2" and larger. Solvent welded joints: Pipe ends deburred, and beveled. Pipe end and fitting: Cleaned and dried, primed to soften bonding surfaces. Pipe end: Apply even full layer of solvent cement after priming. Before cement starts to set, insert pipe end into fitting and turn 1/4 turn to evenly distribute cement. Hold joint together until cement sets-up, wipe excess cement off joint.
- N. Pipe penetrations through walls, floors and ceilings shall be in accordance with Section 23 05 00 "Common Work Results for HVAC". Traverse points of piping shall be escutcheoned with split chrome floor and ceiling plates and spring anchors, where visible to occupancy.
- O. Automatic Air Vents: Shall be installed with a manual isolation valve. The vent discharge shall be piped to a local floor drain.

### 3.3 PIPE HANGERS

- A. Impact driven studs are not acceptable.
- B. Pipes (copper or steel) shall be supported at intervals and rod sizes as follows, double nuts on hangers and on beam clips.

Pipe Size	Hanger Intervals	Rod Sizes
1/2"	5'	3/8"
3/4"	6'	3/8"
1"	7'	3/8"
1-1/4"	8'	3/8"
1-1/2"	9'	3/8"
2"	10'	3/8"
2-1/2"	11'	1/2"
3"	12'	1/2"

- C. Verticals: Supported at the base and at intervals as follows by use of clamp hangers:

Steel Pipe: Not more than 16 ft.

Copper Pipe and Tubing:

1-1/2" and larger - Not more than 12 ft.

1-1/4" and smaller - Not more than 6 ft.

- D. Provide welded steel saddles at each hanger on steel piping systems 4" and larger.
- E. PVC Piping: Supported at 4' intervals.
- F. Spring Isolators: All piping within 20' upstream and downstream of the pumps.

### 3.4 CLOSING IN WORK

- A. Cover up or enclose work after it has been properly and completely tested and reviewed.
- B. No additional cost to the Owner will be allowed for uncovering or recovering any work that is covered or enclosed prior to required test and review.

### 3.5 TEST AND ADJUST

- A. After the installation is complete and ready for operation, test the system under normal operating conditions in the presence of the Architect and demonstrate that the system functions as designed.
- B. Correct defects which develop in operational testing, conduct additional testing until defect free operation is achieved.

### 3.6 INSTRUCTIONS

- A. On completion of the project, instruct the Owner's representative in the care and operation of the system. The period of instruction shall be for not less than one 8 hour period. The time of instruction shall be arranged with the Owner. In addition to the prime Mechanical Contractor and Owner's representative shall be present and participate in the Owner's instruction.

### 3.7 CLEANUP AND CORROSION PREVENTION

- A. Piping and equipment shall be thoroughly cleaned. Dirt, dust, and debris shall be removed and the premises left in a clean and neat condition.
- B. Before covering is applied to piping systems, clips, rods, clevises and other hanger attachments, and before uncovered piping is permitted to be concealed, corrosion and rust shall be wire brushed and cleaned and in the case of iron products, a coat of approved protective paint applied to these surfaces. When corrosion is from the effects of hot solder paste, the areas shall be cleaned and polished and a wash of bicarbonate of soda and water used to neutralize the acid condition.

### 3.8 FIRESTOPPING

- A. Firestopping shall be performed in accordance with Specification Section 07 84 00 "Firestopping". All penetrations of fire-rated assemblies including walls and floors by mechanical system components (piping, ductwork, conduits, etc.) shall be firestopped as specified.

3.9 REFRIGERATION PIPING

A. Refrigeration Piping:

1. Provide and install refrigeration piping, hangers, and accessories as specified and required. The piping installation shall be performed by a qualified refrigeration mechanic under the direct supervision of the equipment manufacturer. Submit records of tests.
2. Refrigeration piping shall be Type ACR copper tube with brazed joints, or as recommended by the equipment manufacturer, nitrogen-charged equal to BCUP-2 Classification of American Welding Society.
3. The refrigeration system shall be tested as follows:

High pressure Side	300 psi
Low Pressure Side	150 psi
4. Support risers, offsets, and equipment, in an acceptable manner.
5. Piping shall be installed to meet Codes and regulations, applicable to the installation and in accordance with the best practice of the trade. Brazing shall be accomplished while sweeping piping with nitrogen.
6. Refrigerant accessories shall include required valves and fittings to provide a complete installation. Refrigerant suction and hot gas piping shall be insulated with 3/4" thick Armaflex Type AP, or equal, elastomeric unicellular insulation. Exterior insulation shall have .032" thick circumferentially corrugated aluminum jacketing by Childers, solvent-welded ultraviolet resistant PVC jacketing, or approved equal.
7. Parts of the system not factory charged and field installed piping of components shall be evacuated to within .10 MM/Mercury of a perfect vacuum. Break the vacuum to 0 psig with oil-free nitrogen before charging. Hold vacuum overnight for leak test.
8. Provide complete charges of refrigerant and oil to be maintained for the guarantee period.
9. Elbows shall be long radius.
10. The installation shall be in accordance with the above, with equipment manufacturer's instructions, and with established recommended practices.
11. System installation shall include the following:

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- a. Pitch lines down in direction of flow a minimum of 1/2 inch per 10 feet.
- b. Trap suction risers as verified with the equipment manufacturer.
- c. Provide service valves on liquid and suction piping at air cooled condensing units.
- d. Maximum filter-dryer pressure drops:  
1 psi for liquid line filter-dryer.
- e. Liquid line solenoid valve on each refrigeration circuit.
- f. Thermal expansion valve on each refrigeration circuit.



**APPENDIX A**  
**ROOFTOP AIR CONDITIONING UNITS**

## 3-10 Ton R410A PKGD Unitary Gas/Electric Rooftop

### Job Information

		16 Middle Street TIG
Tag	AC-1-14	
Quantity	1	Model number YHC092

### Unit Information

Tonnage	7.5 Ton Dual compressor	Unit function	DX cooling, gas heat
Min. unit operating weight	1026.0 lb	Max. unit operating weight	1291.0 lb
Design Airflow	2800 cfm		

### Cooling Information

Gross Total Capacity	90.59 MBh	Gross Sensible Capacity	66.99 MBh
Gross Latent Capacity	23.60 MBh	Net Total Capacity	87.30 MBh
Net Sensible Capacity	63.70 MBh	Net Sensible Heat Ratio	0.73 Number
Cooling Entering DB	80.00 F	Cooling Entering WB	67.00 F
Cooling Leaving Unit DB	59.30 F	Cooling Leaving Unit WB	57.06 F
Ambient Temp	95.00 F		

### Heating Information

Heating capacity	Medium gas heat 3ph	Input Heating Capacity	150.00 MBh
Output Heating Capacity	120.00 MBh	Heating EAT	70.00 F
Heating LAT	109.90 F	Heating Delta T	39.90 F

### Motor/Electrical Information


Voltage	208-230/60/3	Design ESP	1.000 in H2O
Indoor Motor Power	0.90 kW	Indoor mtr operating power	1.20 bhp
Indoor RPM	1189 rpm	Outdoor Motor Power	0.71 kW
Compressor Power	6.06 kW	System Power	7.66 kW
MCA	41.90 A	MOP	50.00 A
Compressor 1 RLA	15.90 A	Evaporator fan FLA	8.50 A
Condenser fan FLA	3.50 A		

Electrical values provided are estimated only and are subject to change without notice and may differ from nameplate values.

Field installed low or high static drive kits may be needed. Please check the fan performance tables in the product catalog for application ranges.

## 3-10 Ton R410A PKGD Unitary Gas/Electric Rooftop

### Job Information

		16 Middle Street TIG
Tag	<b>AC-1-14</b>	
Quantity	<b>1</b>	Model number <b>YHC092</b>

### Information for LEED Projects

ASHRAE 90.1	<b>Yes</b>	IEER	<b>14.50</b>
Refrig charge (HFC-410A) - ckt 1	<b>5.5 lb</b>	Compressor Power	<b>6.06 kW</b>
Refrig charge (HFC-410A) - ckt 2	<b>4.2 lb</b>	Outdoor Motor Power	<b>0.71 kW</b>
Rated capacity (AHRI)	<b>89.00 MBh</b>	Indoor mtr operating power	<b>1.20 bhp</b>
EER @ AHRI Conditions	<b>12.6 EER</b>	Exhaust fan power	<b>0.65 kW</b>

Note: This product meets the minimum equipment efficiency requirements of ASHRAE Standard 90.1-2007 and -2010 (which are based on AHRI standard rating conditions) and, therefore, also meets the LEED "Minimum Energy Performance" prerequisite in the Energy and Atmosphere section. The power data listed above is at actual user-entered conditions. Refer to the product catalog for performance at AHRI standard rating conditions.

The LEED Green Building Rating System™, developed by the U.S. Green Building Council, provides independent, third-party verification that a building project meets green building and performance measures.

Electrical values provided are estimated only and are subject to change without notice and may differ from nameplate values.

Field installed low or high static drive kits may be needed. Please check the fan performance tables in the product catalog for application ranges.

2/9/2016

Product Version

2002.09.04.1

SECTION 23 05 00

SUPPLEMENTAL MECHANICAL GENERAL REQUIREMENTS

PART 1 GENERAL

1.1 RELATED DOCUMENTS

- A. The General Conditions, Supplemental General Conditions and Instructions to Bidders shall apply to this work. Read these to be familiar with conditions related to the installation of the work.
- B. Drawings and general provisions of Contract including General and Supplementary Conditions and all Division 1 specification sections.
- C. Provision of waste management: Section 01 74 19, Construction Waste Management and Disposal.
- D. Coordinate with Section 01 91 00 Commissioning.
- E. Coordinate with Section 01 20 00 Price And Payment Procedures.

1.2 WORK SHOWN ON DRAWINGS

- A. The drawings accompanying this specification, as a part thereof, are working drawings indicating the location and arrangement of the increments of the systems of this section of work. Material deviation from this arrangement, process or means of application, shall bear the Engineer's review stamp before the change is made on the job or materials are ordered. Changes made without such review shall be ordered removed and items installed as specified shall be provided at no additional expense to the Owner.
- B. The drawings are not intended to show in minute detail minor items of installation or materials such as specific fittings or findings.

1.3 MATERIALS AND LABOR

- A. Furnish materials and labor necessary to deliver to the Owner a complete and operable system installed in accordance with the contract documents.
- B. Materials shall be of the best quality. Workmanship shall be of highest grade and construction shall be done according to best practices of the trade.
- C. Provide, when required, labeled samples of material or equipment specified herein or proposed to be used in this work.
- D. Where words "furnish", "provide", or "install" are mentioned, either singly or in combination, these words are hereby interpreted to mean "furnish and install" or "provide and install", including materials complete with connections, supplemental

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devices, accessories and appurtenances, unless specifically otherwise noted. These words are likewise hereby interpreted as being prefixed to materials, equipment, and apparatus hereinafter mentioned, either in abbreviated or scheduled information or in the technical sections of the specifications.

### 1.4 EQUIPMENT INSTALLATION IN HEATING SEASON

- A. The system shall be installed such that the construction area will have sufficient heat to maintain temperature above 40°F throughout the construction period.

### 1.5 COOPERATION BETWEEN TRADES

- A. Provide information sufficiently in advance of this work, so that work by the other trades may be coordinated and installed without delays. Furnish and locate sleeves, supports, anchors and necessary access panels.
- B. Where work is concealed, assure it does not project beyond finished lines of floors, ceilings, or walls.
- C. Equipment or piping requiring access found to be located above sheetrock ceilings shall be brought immediately to the attention of the Architect for resolution.

### 1.6 ORDINANCES, AUTHORITIES, PERMITS, AND FEES

- A. Obtain necessary permits and licenses, give notices and comply with laws, ordinances, rules, regulations or orders affecting the work, and pay fees and charges in connection therewith.
- B. The "authority having jurisdiction" is the organization, office, or individual responsible for "approving" equipment, an installation, or a procedure.

### 1.7 PROTECTION OF WORK AND MATERIALS

- A. Protect and care for materials delivered and work performed until the completion of the work. Defective equipment or equipment damaged in the course of storage, installation or test shall be replaced or repaired to the satisfaction of the Engineer at no additional cost to the Owner.

### 1.8 INSURANCE

- A. Purchase and maintain Public Liability and Property Insurance during the progress of the work and until completion and acceptance of the entire project by the Owner in the amounts as specified in the General Conditions.

### 1.9 APPLICABLE CODES

- A. Work and materials shall conform to the latest rules and regulations listed below and these rules and regulations hereby are made part of this specification. They include, but are not necessarily limited to the following:

American Society for Testing and Materials (ASTM)  
Underwriters' Laboratories, Inc. (UL)  
Air Moving and Conditioning Assoc. (AMCA)  
American Society of Heating, Refrigerating, and Air  
Conditioning Engineers (ASHRAE)  
American Society of Mechanical Engineers (ASME)  
National Electrical Manufacturers Association (NEMA)  
Institute of Electrical and Electronics Engineers (IEEE)  
American National Standards Institute (ANSI)  
National Fire Protection Association (NFPA)  
American Water Works Association (AWWA)  
Local Fire Code  
Local Plumbing Codes  
American Welding Society  
International Building Code (IBC)

#### 1.10 SHOP DRAWINGS

- A. Submit shop drawings, manufacturers' data and certificates for equipment, materials and finish, and pertinent details for each system where specified in each individual section, five (5) copies, to be submitted to the Architect. Shop drawings will be returned "No Exceptions Taken", "Make Corrections Noted", "Amend and Resubmit", "Submit Specified Item", or "Rejected" less two (2) copies. Work shall progress in accordance with "Reviewed" shop drawings (ONLY).
- B. **Shop drawings that are facsimiled, (FAX) produced, or photocopies of FAX documents OR EMAILED will not be considered or reviewed. Only originals and or photocopied originals, complying with this section will be considered.**
- C. Groups of similar shop drawings shall be submitted as individual bound documents with covers and indexes. Typical similar items would be "Diffusers and Registers", "Valves and Controls". Rejection of individual items shall not be cause for rejection of the entire document.
- D. **Clearly indicate item(s) to be reviewed on each submission by highlighting or underlining intended item(s). Submissions not clearly marked shall be returned "Amend and Resubmit".**
- E. Shop drawings must bear the Engineer's review stamp. In the event that the Engineer returns shop drawings "Amend and Resubmit" or "Rejected", the shop drawing must be revised and resubmitted for review.
- F. Furnishing of the specified item must still produce the results and performance, dependability and quality reasonably to be expected within the spirit of the specifications, drawings, and the standard of good mechanical performance normal to the trade.
- G. Section 01 33 00 - Submittal Procedures: Submittal procedures.

- H. Product Data: Submit data on product characteristics, performance criteria and limitations.
- I. Manufacturer's Installation Instructions: Submit procedure for preparation and installation.
- J. Manufacturer's Certificate: Certify products meet or exceed specified requirements.

#### 1.11 SUBSTITUTIONS

- A. Where the specifications allow the substitution of a product, still this product is subject to review by the Engineer in accordance with the paragraph entitled "Shop Drawings". Review of a substitute item is an indication only that the substitute item is compatible with the specified item as a claim of the manufacturer. Insure dimensional propriety, performance, and quality of the substitute item.
- B. Reference in the specifications or on the drawings to any product, material, fixture, form or type of construction, by proprietary name, manufacturer, make or catalog number, establishes a standard of quality or design and is not meant to limit competition. Use any equivalent substitute provided favorable written review by the Engineer is first obtained. The (ONLY) notation in the specification is an exception to this and leaves no option.
- C. For materials or equipment which are supplied with integral or factory applied finish, the colors will be considered in evaluating substitutions.
- D. For the purpose of avoiding conflicts with other trades, contracts, and adjoining work where more than one (1) article, device, material, fixture, form or proprietary name, manufacturer, make or catalog number, the first named shall be used as the basis of design and details. The cost of any changes because of substituted item shall be borne by the Contractor requesting such change.

#### PART 2 PRODUCTS

NOT USED

#### PART 3 EXECUTION

##### 3.1 EQUIPMENT SUPPORTS

- A. Furnish and install equipment supports for mechanical equipment as required. Supports shall be subject to review by the Engineer.

##### 3.2 SLEEVES AND PREPARED OPENINGS

- A. Coordinate cutting, patching and setting of sleeves, frames, framing and lintels for openings with other trades. Sleeves shall be furnished by the Contractor. All penetrations through concrete shall be sleeved as required by IBC.

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- B. Failure to give timely notice of and to locate openings and furnish sleeves shall cause no additional expense to the Owner.

### 3.3 CONNECTION TO EQUIPMENT

- A. Provide piping connections, supports, brackets, compensators or flexible connections to prevent application of excessive stresses to equipment.
- B. Equipment shall be installed with flanges or unions in such a manner as to permit disconnecting for removal of tubes, coils, elements and other equipment for inspection, service and repairs.

### 3.4 ACCESS TO EQUIPMENT

- A. The installation of work performed shall provide reasonable accessibility for operation, inspection, and maintenance of equipment and accessories. The Engineer shall determine the adequacy of such accessibility.

### 3.5 ACCESS PANELS

- A. Access panels shall be provided where indicated on the drawings and as required for access to valves and other serviceable components.
- B. Access panels installed in fire-rated assemblies shall have the same fire rating as the assembly.

### 3.6 PAINTING OF EQUIPMENT

- A. Exposed ironwork, including steel supports and hangers in unfinished spaces, mechanical rooms, pits, and trenches shall be properly cleaned, prepared and painted with two (2) coats of black asphaltum varnish.

### 3.7 GUARDS

- A. Exposed moving and rotating elements of mechanical equipment items shall be protected with suitable guards for personnel protection. Guards shall be of rigid construction, firmly positioned. Holes shall be provided in guards at shaft centers to facilitate tachometer readings.

### 3.8 LUBRICATION

- A. Furnish and install grease fittings for points requiring lubrication. Furnish extension type fittings as required to provide easy access for maintenance lubrication.
- B. Furnish initial charges of lubricants for equipment. Lubricants shall be in conformance with the manufacturer's requirements and recommendations.



3.9 ELECTRIC MOTORS AND MOTOR CONTROLS

- A. Unless otherwise noted, motors, motor starters and other electrical accessories which are specified under Mechanical specifications shall be selected with characteristics as follows:  
  
1/2 Horsepower and less - 120 volt, 1 phase, 60 Hz.
- B. Motors shall be built in accordance with the latest applicable NEMA, IEEE and ANSI Standards. Motors shall be of the latest type and quality specified under individual items of equipment.
- C. Magnetic motor starters for mechanical items of equipment shall be furnished under Division 16 unless the starter is an integral part of a factory packaged item of equipment. Each starter furnished as an integral item of equipment shall be provided with overload heater elements. Starters shall have single phase protection or shall have relays installed to provide this feature. Starters shall be equipped with suitable step-down transformers to provide required control voltage.
- D. Motors shall have a minimum continuous duty service factor of 1.15. Minimum motor efficiency shall be:

<u>MOTOR HORSEPOWER</u>	<u>PERCENTAGE EFFICIENCY</u>		
	<u>(1200RPM)</u>	<u>(1800 RPM)</u>	<u>(3600 RPM)</u>
1,1-1/2,2,3	----	78.0	76.0
5	87.4	87.4	86.3
7.5	89.4	89.8	87.7
10	89.7	90.3	89.0

3.10 CLEANING OF SYSTEMS

- A. Piping systems shall be thoroughly cleaned and flushed prior to initial operation.
- B. Thoroughly clean exposed portions of the mechanical installation, removing labels and foreign substance.
- C. Furnish detergents, solvents, cleaning compounds, and tools required for cleaning operations.
- D. Keep the premises free from accumulation of waste material or rubbish and at the completion of the work, remove from the job site tools, scaffolding, surplus materials, and rubbish, leaving the work areas "broom" clean.

3.11 STARTING OF EQUIPMENT

- A. Testing or starting of equipment shall be done in collaboration with trades concerned to insure safe and proper operation of the equipment.

- B. Prior to starting equipment, provide lubrication at required points. Before starting any electrical or electric motor driven equipment, a check must be made to insure that proper heater coils are installed in the starters and that the equipment is rotating in the proper direction.

3.12 OPERATIONAL TESTING

- A. Operate systems until successful operation is demonstrated to the Engineer. This initial operation shall be in addition to the testing of the system and shall be done after the system is cleaned and finished.

3.13 RECORD DRAWINGS

- A. During construction, keep an accurate record of deviations to the installation of the work as indicated on the drawings. Upon completion of the work, furnish a copy of this record to the Engineer. **Submit record drawings before requesting final payment.**

3.14 MANUFACTURER'S REPRESENTATIVE

- A. As indicated in the Technical Sections of this specification or as directed by the Engineer, provide the services of a factory trained Engineer or Technician to inspect, adjust, and place in proper operating condition the equipment or item involved. No additional compensation will be allowed for such service.

3.15 MANUFACTURER'S INSTRUCTIONS, OPERATION AND MAINTENANCE DATA

- A. Provide for each item of equipment or apparatus furnished, a complete set of printed instructions obtained from the manufacturer covering proper operation, maintenance, lubrication, cleaning, servicing, adjustment, and safety instructions.
- B. Manufacturer's data shall include performance data (curves are preferred where applicable) complete parts lists, recommended spare parts lists, piping, and wiring diagrams.
- C. Arrange data in complete sets, properly indexed and marked.
- D. Data shall include a complete set of shop drawings.
- E. Material shall first be submitted in preliminary form for review by the Engineer. After review, submit two (2) copies in bound volumes to the Engineer for distribution.

3.16 GUARANTEES

- A. An item becomes "defective" when it ceases to conform to the Contract Documents. Guarantees begin on the date of issuance of a certificate authorizing final payment or certificate of substantial completion with the Owner taking occupancy or beneficial use thereafter.

- B. Upon completion of the work and before applying for final payment, furnish a written guarantee, stating that the work complies with the provisions of codes listed herein and the local enforcing authorities, and that it will be free from defects of material and workmanship for not less than one (1) year. Guarantee shall further state that the Contractor will, at his own expense, repair or replace any of his material and work which may become defective during the time of guarantee, together with other work damaged as a consequence of such defects.
- C. Repeated malfunctioning or failure in service of any item or work of the system is sufficient cause for the Engineer to order the removal of the item, and its replacement with new item at the expense of the Contractor.

### 3.17 FIRESTOPPING

- A. Firestopping shall be performed in accordance with Specification Section 07 84 00 "Firestopping". All penetrations of fire-rated assemblies including walls and floors by mechanical system components (piping, ductwork, conduits, etc.) shall be firestopped as specified.

\* END OF SECTION \*

SECTION 23 07 00

INSULATION

PART 1 GENERAL

1.1 RELATED DOCUMENTS

- A. The drawings and the specifications including Section 23 05 00 "Supplemental General Mechanical Conditions" are hereby made a part of the work of this section.
- B. Drawings and general provisions of Contract including General and Supplementary Conditions and all Division 1 specification sections.
- C. Provision of waste management: Section 01 74 19, Construction Waste Management and Disposal.
- D. Coordinate with Section 01 20 00 Price And Payment Procedures.

1.2 DESCRIPTION

- A. The work covered by this Section of the specifications includes the furnishing of labor, materials, equipment, transportation, permits, inspections and incidentals and the performing of operations required to insulate the ventilating and plumbing systems.

1.3 SUBMITTALS

- A. Substitutions: Your attention is directed to Section 23 05 00-"Substitutions", relative to competition and the (ONLY) notation. Familiarity with this section shall be achieved before reading the PRODUCTS section of this specification.
- B. The items for which the submittals paragraph in Section 23 05 00, Supplemental General Mechanical Requirements, apply are as follows:
  - 1. Piping insulation.
  - 2. Duct insulation.
  - 3. Insulation application schedule.
  - 4. Vapor barrier coating.
- C. Section 01 33 00 - Submittal Procedures: Submittal procedures.
- D. Product Data: Submit data on product characteristics, performance criteria and limitations.
- E. Manufacturer's Installation Instructions: Submit procedure for preparation and installation.
- F. Manufacturer's Certificate: Certify products meet or exceed specified requirements.

1.5 DEFINITIONS

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- A. Finished Spaces: Spaces other than furred spaces, pipe and duct shafts, unheated spaces immediately below roof, spaces above ceilings, unexcavated spaces, crawl spaces, and tunnels, unless specifically listed below as an unfinished space.
- B. Unfinished Spaces: Mech/Elect Rooms and attic.
- C. Unconditioned Spaces: Spaces exposed to near outside ambient temperatures (attic) and spaces not air conditioned.
- C. Outside: Areas beyond the exterior side of walls or above the roof, unexcavated spaces, and crawl spaces.
- D. Concealed: Not visible in finished or unfinished spaces. For example, above ceilings, below floors, between double walls, furred-in areas, pipe and duct shafts, and similar spaces.
- E. Exposed: Visible from a finished or unfinished space.

### 1.6 MANUFACTURER'S STAMP OR LABEL

- A. Packages or standard containers of insulation, jackets, cements, adhesives, and coatings delivered to the project site for use must have the manufacturer's stamp or label attached giving name of manufacturer, brand, and description of material. Insulation shall be asbestos-free.

### 1.7 FLAME SPREAD AND SMOKE DEVELOPED RATINGS

- A. Materials shall have a flame-spread rating of not more than 25 and a smoke developed rating of not more than 50 when tested in accordance with NFPA 255, ASTM E84, or UL 723.
- B. Provide materials with flame resistant treatments not subject to deterioration due to aging, moisture, high humidity, oxygen, ozone, or heat.
- C. Materials Exempt From Fire-Resistant Rating: Nylon anchors for securing insulation to ducts or equipment.

## PART 2 PRODUCTS

### 2.1 PIPING INSULATION

- A. Fiberglass: Heavy density preformed fiberglass with thermal conductivity of 0.29 Btu-in/hr-ft<sup>2</sup>-°F at 150°F mean temperature. Insulation shall conform to ASTM C547 Class I and shall be suitable for 450°F service. Fitting insulation shall be of same material used for pipe.
  - 1. Insulation Jacket: All service (ASJ) type conforming to Fed. Spec. HH-B-100B Type I. Jacket permeability shall not exceed 0.02 perms (ASTM E96). Pipe fitting jacket shall be factory premolded, one-piece, PVC covers with pressure sensitive taped joints. Jackets in exposed locations shall have a white surface suitable for field painting. Provide vapor barrier as required by service.

- B. Flexible Unicellular: Flexible unicellular with thermal conductivity of 0.27 Btu-in/hr-ft<sup>2</sup>-°F at 75°F mean temperature. Insulation shall conform to ASTM C534, Type I, Tubular and shall be suitable for 200°F service. Fitting insulation shall be of same material used for pipe. Permeability shall not exceed 0.10 perms (ASTM E96). Insulation adhesive shall conform to Mil. Spec. MIL-A-24179A, Type II, Class 1.
- C. Fittings, Flanges, and Valves: Provide insulation for fittings, flanges, and valves premolded, precut, or job fabricated of the same thickness and conductivity as used on adjacent piping.
- D. Insulation Kit: Insulate exposed supply and waste piping at handicapped accessible sinks with fully molded insulation kit. McGuire Products ProWrap, 3/16" thick closed vinyl with anti-microbial additive, 1.02 Btu-in/hr-F<sup>2</sup>-°F thermal conductivity, white color.

## 2.2 EQUIPMENT INSULATION

- A. Fiberglass (Hot Equipment): Semi-rigid fiberglass board conforming to Fed. Spec. HH-I-558B, Form B, Type I. Thermal conductivity shall be 0.32 Btu-in/hr-ft<sup>2</sup>-°F at 150°F mean temperature (ASTM C177), insulation shall be suitable for 650°F service. Insulation jacket shall be "all service" type conforming to Fed. Spec. HH-I-100B Type I or II. Jacket permeability shall not exceed 0.02 perms (ASTM E96).
- B. Flexible Unicellular (Cold Equipment): Flexible unicellular with thermal conductivity of 0.27 Btu-in/hr-ft<sup>2</sup>-°F at 75°F mean temperature. Insulation shall conform to ASTM C534, Type II, sheet and shall be suitable for 200°F service. Permeability shall not exceed 0.10 perms (ASTM E96). Insulation adhesive shall conform to Mil. Spec. MIL-A-24179A, Type II, Class 1.

## 2.3 DUCT INSULATION

- A. Fiberglass (Ductwrap): Fiberglass duct wrap with foil-scrim-kraft facing/vapor barrier, 1.0 lb/cu.ft. density (0.75 lb/cu.ft. for 3" thickness only), 0.29 Btu-in/hr-ft<sup>2</sup>-°F conductivity at 75°F mean temperature, 0.05 permeance rating. Insulation shall meet the requirements of NFPA 90A & B and shall be UL rated. Provide foil-scrim-kraft (FSK) tape.

## 2.4 VAPOR BARRIER COATING

- A. Raw (cut) ends of fiberglass pipe insulation shall be finished (protected) with the application of a suitable vapor barrier coating or finishing cement (mastic) to maintain the continuous visual and functional integrity of the insulation jacket. Mastic shall be Childers "Chil-Perm" CP-30, elastomeric resin, or approved equal, applied in accordance with the manufacturer's recommendations.

## 2.5 KITCHEN HOOD EXHAUST DUCTWORK INSULATION

- A. Provide two (2) layers of 1½" thick Firemaster or FyreWrap high temperature ceramic insulation with up to a two (2) hour fire rating and 0" clearance to combustibles at each commercial kitchen hood per NFPA96. Install on commercial kitchen hood exhaust ductwork per the manufacturers recommendations.

PART 3 EXECUTION

3.1 SURFACE CONDITIONS

- A. Inspection:
1. Prior to work of this Section, carefully inspect the installed work of other trades and verify that such work is complete to the point where this installation may properly commence.
  2. Verify that the insulation systems may be installed in accordance with pertinent codes and regulations and the reviewed Submittals.

3.2 GENERAL

- A. Insulate after system tests have been completed and surfaces to be insulated have been cleaned of dirt, rust, and scale and are dry.
- B. Install insulation with jackets drawn tight and cement down longitudinal and end laps. Do not use scrap pieces where a full length section will fit. Insulation shall be continuous through sleeves, wall and ceiling openings, except at fire dampers in duct systems and pipe penetrations through fire rated assemblies. Extend surface finishes to protect ends, and raw edges of insulation. Apply coatings and adhesives at the manufacturer's recommended coverage per gallon. Individually insulate piping and ductwork. Keep insulation dry during the application of the finish. Bevel and seal the edges of exposed insulation.
- C. Unless otherwise indicated, do not insulate the following:
1. Factory pre-insulated flexible ductwork.
  2. Factory pre-insulated ductwork, plenums, casings, mixing boxes, and filter boxes.
  3. Chrome plated pipes and fire protection pipes.
  4. Vibration isolating connections
  5. Adjacent insulation
  6. ASME stamps, nameplates, access plates
  7. Ductwork exposed to view in a normally occupied space.
  8. Hydronic specialties: Low water cutoff, relief valves, relief valve discharge piping, pressure reducing valves, and expansion tanks.
  9. Unions and flanges at equipment required for frequent service.

3.3 PIPING INSULATION

- A. Pipe Insulation (Fiberglass): Place sections of insulation around the pipe and joints, tightly butt into place. Draw jacket laps tight and smooth. Secure jacket with fire resistant adhesive, or factory applied self sealing lap. Cover circumferential joints with butt strips, not less than 3-inches wide, of material identical to the jacket material. Overlap longitudinal laps of jacket material not less than 1-1/2 inches. Adhesive used to secure the butt strip shall be the same as used to secure the jacket laps. Exposed fiberglass shall be coated with vapor barrier coating.

- B. Flanges, Unions, Valves and Fittings Insulation (Fiberglass): Factory fabricated removable and reusable insulation covers. Place factory pre-molded, precut or field-fabricated segmented insulation of the same thickness and conductivity as the adjoining pipe insulation around the flange, union, valve, and fitting abutting the adjoining pipe insulation. Install factory premolded one-piece PVC fitting covers over the insulation and secure by stapling or with metal or plastic tacks made for securing PVC fitting covers and secure with PVC vapor barrier tape.
- C. Pipe Insulation (Flexible Unicellular): Bond cuts, butt joints, ends, and longitudinal joints with adhesive. Miter 90-degree turns and elbows, tees, and valve insulation. Insulate flanges, unions, valves, and fittings.
- D. Where penetrating roofs and exterior walls, insulate piping to a point flush with the underside of the deck or wall and seal with a vapor barrier coating.
- E. Hangers and Anchors: Pipe insulation shall be continuous through pipe hangers. Where pipe is supported by the insulation, provide MSS SP-58, Type 40 galvanized steel shields (16 gage maximum). For fiberglass insulation systems on pipe sizes 2 inches through 3", provide insulation inserts at points of hangers and supports. Insulation inserts shall be of molded glass fiber (minimum 12 pcf). Insulation inserts shall cover the bottom half of the pipe circumference, 180 degrees, and be not less than 4" long. Vapor-barrier facing of the insert shall be of the same material as the facing on the adjacent insulation. Seal inserts into the insulation. Insulation inserts for pipe sizes 4" and larger shall be welded pipe saddles. Install insulation in void area of saddle of same material used on adjacent insulation. For pipe sizes 2" and smaller, insulation inserts for flexible unicellular insulation systems shall be wooden doweling set on end of length equal to insulation thickness. Seal dowel to insulation with adhesive.

### 3.4 DUCT INSULATION

- A. Rigid Insulation: Secure rigid insulation by impaling over pins or anchors located not more than 3 inches from joint edges of boards, spaced not more than 12 inches on centers and secure with washers and clips. Spot weld anchor pins or attach with a waterproof adhesive especially designed for use on metal surfaces. Each pin or anchor shall be capable of supporting a 20-pound load. Cut off protruding ends of pins. After installing washers, provide foil-scrim-kraft (FSK) tape to seal break in vapor barrier, tape shall extend 1" minimum around pin. Apply insulation with joints tightly butted. Bevel insulation around name plates and access plates and doors. Seal joints with FSK tape. Provide additional adhesive or staples to assist tape adhesion in difficult applications.
- B. Flexible Blanket Insulation: Apply insulation with joints tightly butted. Staple laps of jacket with outward clinching staples and seal with foil scrim kraft (FSK) tape. Sagging of flexible duct insulation shall not be permitted. For ductwork over 24-inches wide on horizontal duct runs, provide pins, washers and clips. Install speed washers with pins and pin trimmed to washer. Cut off protruding ends of pins after clips are secured. Seal with FSK tape, extend tape 1" minimum around pin. Use pins on sides of vertical ductwork being insulated. Space pins and clips on 18 inch centers and not more than 18 inches from duct corners. Carry insulation over standing seams and trapeze-type hangers.



3.6 INSULATION APPLICATION SCHEDULE

<u>SERVICE</u>	<u>THICKNESS</u>	<u>MATERIAL/JACKET</u>
PIPING:		
Domestic Cold Water Piping		
1" and smaller	1/2"	Fiberglass w/ASJ or Flexible Unicellular
1¼" and larger	1"	Fiberglass w/ASJ or Flexible Unicellular
Domestic Hot Water Piping and Domestic Hot Water Recirculation Piping		
2" and smaller	1½"	Fiberglass w/ASJ or Flexible Unicellular
2½" and larger	2"	Fiberglass w/ASJ
Domestic Water Branch Piping Less than 10 ft in Stud Walls	1/2"	Fiberglass w/ASJ or Flexible Unicellular
Water and Drain Piping Under Handicap Accessible Fixtures		Insulation Kit (Truebro)
PEX Tubing for domestic water	1/2"	Flexible Unicellular
Roof Drain Piping	1"	Fiberglass w/ ASJ
Condensate Drain Piping	½"	Flexible Unicellular

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<u>SERVICE</u>	<u>THICKNESS</u>	<u>MATERIAL/JACKET</u>
DUCTWORK:		
Exhaust Ductwork from a point three (3) feet interior of the motorized control damper or backdraft damper to the exterior wall, roof, or louver.	2"	Ductwrap, FSK
Supply Ductwork from AC units to the Spaces Served	1½"	Ductwrap, FSK
Kitchen Hood Exhaust Ductwork	3"	FyreWrap, Two (2) 1½" thick layers
EQUIPMENT:		
Water Meter	1/2"	Flexible Unicellular
Backflow Preventers	1/2"	Flexible Unicellular

3.7 FIELD INSPECTION

- A. Visually inspect to ensure that materials used conform to specifications. Inspect installations progressively for compliance with requirements.

\* END OF SECTION \*

SECTION 23 09 00

AUTOMATIC TEMPERATURE CONTROLS

PART 1 GENERAL

1.1 DESCRIPTION

- A. The work covered by this Section of the specifications includes the furnishing of labor, materials, equipment, transportation, permits, inspections and incidentals and the performing of operations required to install the automatic temperature control system indicated. The system shall be a direct digital control (DDC) system with touch-screen human interface panel or web-based access and graphics software providing the sequences as described in these specifications. The ATC system shall be complete with required components including, low voltage and line voltage wiring and conduit. Wiring shall be in accordance with Division 16 of the specifications and NFPA 70, National Electrical Code.
- B. The automatic temperature controls system shall be provided and installed by trained control mechanics regularly employed in the installation and calibration of ATC equipment by one of the manufacturers' of such equipment, as listed below. Control installation by any Contractor whose principle business is not direct manufacture and installation is prohibited.

1.2 ACCEPTABLE MANUFACTURERS / INSTALLERS

- A. Maine Controls.
- B. Basix Automation / Andover.
- C. Siemens Industry, 66 Mussey Road, Scarborough, ME. 04074
- D. Northeast Controls (Circon).
- E. Honeywell, Inc., Westbrook, ME
- F. IB Controls (Delta / Johnson).

1.3 RELATED DOCUMENTS

- A. The drawings and the specifications including Section 23 05 00 "Supplemental Mechanical General Requirements" and Section 26 00 00 "Electrical" are hereby made a part of the work of this section.
- B. Coordinate with Section 01 91 00 Commissioning.
- C. Drawings and general provisions of Contract including General and Supplementary Conditions and all Division 1 specification sections.
- D. Provision of waste management: Section 01 74 19, Construction Waste Management and Disposal.
- E. Coordinate with Section 01 20 00 Price And Payment Procedures.

#### 1.4 SUBMITTALS

- A. Substitutions: Your attention is directed to Section 23 05 00 relative to competition and the (ONLY) notation. Familiarity with this section shall be achieved before reading the PRODUCTS section of this specification.
- B. The items for which the shop drawings paragraph in Section 23 05 00, Supplemental General Mechanical Requirements, apply are as follows:
  - 1. Temperature control system schematic including variables, flow diagrams, ladder diagrams, and point to point wiring diagrams, indicating set points, reset ranges, throttling ranges, controller gains, differentials, operating ranges, normal positions, controller action, dial ranges, voltages, currents, mounting locations, indicators, and terminal strip points.
  - 2. Sequence of operation for each system and function.
  - 3. Generic, functional description of each control component indicated.
  - 4. Equipment interlocks required by sequence of operation.
  - 5. Automatic valve schedule showing flow, Cv, and pressure drop.
  - 6. Manufacturer's Data:
    - a. Dampers, valves and operators.
    - b. Controllers, including wiring and connection diagrams.
    - c. Thermostats, temperature sensors, including wiring and connection diagrams.
    - d. Temperature and pressure indicators.
    - e. Pressure sensors, including wiring and connection diagrams.
    - f. Switches, relays, transmitters, transformers, including wiring and connection diagrams.
  - 7. Human interface panel or web access with color graphics software data.
- D. Section 01 33 0 - Submittal Procedures: Submittal procedures.
- E. Product Data: Submit data on product characteristics, performance criteria and limitations.
- F. Manufacturer's Installation Instructions: Submit procedure for preparation and installation.
- G. Manufacturer's Certificate: Certify products meet or exceed specified requirements.

#### 1.5 COMMISSIONING

- A. Mechanical systems and controls in this project will be commissioned by an independent commissioning agent hired by the owner. The ATC contractor will be responsible for carrying out the commissioning requirements specified in Section 01 91 00 -

Commissioning, and other sections referenced in 01 91 00, at no additional cost to the owner.

- B. The ATC contractor shall provide a qualified technician to assist the commissioning agent to perform all the functional tests for the HVAC equipment. The functional testing will involve checks of the sequence of operation by observing control system responses to setpoint adjustments, various input values (such as temperature, time, humidity, CO2 level, etc.)
- C. The ATC contractor shall provide remote access to the control system to the commissioning agent so that periodic system observations can be performed by the commissioning agent from a remote location, without additional costs or fees.
- D. The ATC contractor shall set up and provide access to trend logs for monitoring purposes as requested by the commissioning agent.

## 1.6 WARRANTY

- A. The automatic temperature control system shall have a **two (2) year parts and labor** warranty.

## PART 2 PRODUCTS

### 2.1 CONTROL PANELS

- A. In general, relays, transformers, or other control devices (not including room thermostats or duct-mounted instruments) shall be grouped and mounted in a factory-built cabinet enclosure.

### 2.2 AUTOMATIC CONTROL DAMPERS

- A. Automatic dampers not furnished with equipment shall be furnished under this paragraph. Automatic dampers shall be constructed and installed in accordance with the following specifications:
  - 1. Damper Blades: All automatic dampers, including dampers for static pressure control, shall be of the balanced type, factory-fabricated, with fully gasketed galvanized steel airfoil blades, mounted in welded frames. Damper blades shall be not more than 8 inches wide, shall have interlocking edges, edge and jamb seals and be capable of operation against 4" static pressure differential. Dampers shall be Arrow "Arrow-Foil" Model PBDAF-206, OBDAF-207, Ruskin Model CD-60 or Tamco Series 1000.
  - 2. Modulating Dampers: All modulating dampers shall be of the opposed blade type.
  - 3. Damper Size and Bearings: Damper blades shall have steel trunnions mounted in oil-impregnated bearings. Dampers shall be not more than 48 inches in length between bearings.

4. Frames: Damper frames shall be of welded channel or angle-iron, with heavy steel corner gussets and braces or stiffened with steel tie-rods where necessary. Frames shall be painted with aluminum paint to prevent rusting.
  5. Dampers shall be guaranteed to close tightly, and shall provide substantially the full area of the opening when open. All outdoor air intakes and all exhaust ducts to outside and all fresh air, return air and exhaust air dampers in systems shall have damper blades with inflatable seals or other devices to guarantee low leakage, not to exceed 4 CFM/SF at 1 in. WG pressure differential.
  6. Damper Linkages: Damper-operating links shall be cadmium plated steel or brass rods, adjustable in length with ball and socket joints and of such proportions that they will withstand, without appreciable deflection, a load equal to not less than twice the maximum operating force of the damper motor. Linkages shall be concealed in the frame.
- B. Damper Actuators: For each automatically controlled damper, a suitable damper actuator or actuators shall be provided in accordance with the following specifications:
1. Actuator: Damper actuators shall be electronic, direct-coupled, spring-return type and have a rating of not less than twice the torque needed for actual operation of the damper.
  2. Adjustments: Provide adjustable stops for the open and closed positions.
  3. Mounting: Damper actuators shall be direct-coupled over the shaft. The damper actuators and mounting base shall not be mounted directly on cold or insulated ducts and casings, but shall be mounted outside the insulated covering in such a manner as to prevent sweating and interference with the insulation.
  4. Where indicated, damper actuators shall be provided with an auxiliary switch rated at 120 V AC, and accept a 4 to 20 ma input.

### 2.3 AUTOMATIC CONTROL VALVES (HOT WATER, 250°F MAX.)

- A. Valves shall have removable composition discs with monel stem. Bodies two inches or smaller shall be bronze with screwed ends. Bodies 2-1/2 inches and larger shall be cast-iron with flanged ends. Valve bodies, trim and stuffing boxes shall be designed for not less than 125 psi working pressure. Valve packing shall be non-lubricated teflon packing suitable for hot water service, as required.
- B. Modulating valves shall be sized for maximum pressure drop of 1.5 to 4.0 psi.
- C. Automatic control valve differential shut-off pressure shall be a minimum of 35 psig.
- D. Heating valves shall fail to the "normally-open" position with a manual override switch.
- E. Valves shall have a clearly marked position indicator as part of the operating linkage.

- F. Actuator: Shall be electronic, direct-coupled, spring-return type and have a rating of not less than twice the torque needed for actual operation of the valve.

#### 2.4 TEMPERATURE SENSORS

- A. Temperature Sensors: RTD Elements, accuracy of  $\pm 0.1\%$  at 70°F, sensors shall be securely attached to a single gang electrical box or other suitable base, securely mounted on the wall or other building surface. Each sensor shall be located where shown or, if not shown, where it will respond to the average temperature in the room. Sensors, generally, shall be mounted 48 inches above the floor within ADA reach guidelines, and shall not be mounted on outside walls if other locations are possible. If located on an outside wall, it shall have an insulated base. Sensors shall have adjustment devices, by means of which the operating points can be adjusted through a range of not less than 10 degrees above and below the operating points specified.
- B. No devices containing mercury are permitted.
- C. Thermostats in “public/common areas” shall have guards.
- D. Temperature sensors located in living units shall have an adjustable setpoint and temperature display with the maximum heating setpoint limited by the central controller for each sensor.

#### 2.5 OPERATOR INTERFACE PANEL (OR WEB BASED ACCESS)

- A. Operator Interface Panel shall be a wall mounted touch screen interface panel by Delta or equal. The screen shall be a 7 inch diagonal, high resolution, wide-screen format, color LCD. The screen shall be capable of displaying and changing all controlled variables. The terminal shall be capable of displaying the system point name (up to 30 characters), current value, priority and status. It shall trend and display alarms. The display shall be an LCD screen.
  - 1. Locate in the Managers Office or Mechanical room or as indicated on drawings unless directed to another location by the Owner.
  - 2. System shall be dial-in (or web access) and trending capable.
  - 3. The display shall have a minimum of 72 hour capacitor or battery back-up.

#### 2.6 SEQUENCE OF CONTROL

- A. Provide and install all required components to enable the mechanical system to operate in the following sequences:
  - 1. Make-Up Air Units (MUA-1, 2):
    - a. Fans: Supply fans shall operate continuously. The motorized dampers shall open and end switches shall energize the fans.

- b. Supply Air Temperature: The gas heating / DX cooling operation shall be from room sensors located as indicated. The compressors / condensing unit shall be locked out if the unit is off or the outside air temperature is below 60F. (adjustable).
  - c. Freeze Protection: A manual reset freezestat shall shutdown the fans and close the outside air dampers if the discharge air drops below 45°F.
  - d. Motorized Dampers: Outside air and exhaust air motorized dampers shall close upon unit shutdown.
  - e. Fire/Smoke Detector/Damper Actuation: Shall be interlocked via end switch with the MUA to open prior to the fans starting and to shut down prior to the dampers going fully closed. The actuation of the fire/smoke detector/dampers shall de-energize the units and close the outside air and exhaust dampers. This function shall send an alarm to the BAS and fire alarm system.
  - f. A return air relative humidity sensor shall stage the air cooled condensing unit to maintain the setpoint (50%RH). The condensing unit shall be electrically interlocked with the MUA.
2. Combination Fire / Smoke Dampers: Shall be electrically interlocked via end switches with the respective Make-Up Air Unit to open prior to the fans starting and to shut down the units prior to the dampers going closed. If smoke is detected by any of the duct smoke detectors, the dampers shall close and that systems fans shall shut down and an alarm sent to the BAS. See Specifications Section 233000.

### PART 3 EXECUTION

#### 3.1 SURFACE CONDITIONS

- A. Inspection:
  - 1. Prior to work of this Section, carefully inspect the installed work of other trades and verify that such work is complete to the point where this installation may properly commence.
  - 2. Verify that the automatic temperature control and system may be installed in strict accordance with pertinent codes and regulations and the reviewed Shop Drawings.

#### 3.2 INSTALLATION

- A. Provide wiring, and conduit to connect the ATC components for an operational ATC system. Wiring and installation shall conform to NFPA 70.
- B. Identification: Label or code each field wire at each end. Permanently label or code each point of field terminal strips to show the instrument or item served. Color-coded cable with annotated cable diagrams may be used to accomplish cable identification.



- C. Temperature Sensors: Stabilize sensors to permit on-the-job installation that will require minimum field adjustment or calibration. Temperature sensor assemblies shall be readily accessible and adaptable to each type of application to allow quick, easy replacement and servicing without special tools or skills. Strap-on sensor mountings, using helical screw stainless steel clamps, shall be permitted on new piping for unit heater or other on-off operation only, after pipe is cleaned to bright metal. Strap-on bulb and pipe shall be insulated after installation. Strap-on sensor mountings are also permitted for hot water piping sizes up to 2 inches. Other liquid temperature sensors shall be provided with wells.
- D. Duct Sensors: Provide sensors in ductwork; specific location within duct shall be selected to accurately sense air properties. Do not locate sensors in dead air spaces or positions obstructed by ducts or equipment. Installation shall be within the vibration and velocity limits of the sensing element. Where an extended surface element is required to sense the average or lowest air temperature, position and securely mount sensor within duct in accordance with sensor manufacturer's recommendations. Temperature sensing elements shall be thermally isolated from brackets and supports. Provide separate duct flange for each sensing element; securely seal ducts where elements or connections penetrate duct. Seal penetrations of duct insulation vapor barrier with vapor barrier coating compound to provide a vapor-tight covering. Mount sensor enclosures to allow easy removal and servicing without disturbance or removal of duct insulation or vapor barrier. On downstream side of each sensor, provide access doors.
- E. Pipe Sensors: Provide wells for sensors measuring temperatures in pressure vessels or in pipes. Wells shall be noncorrosive to the medium being measured and shall have sufficient physical strength to withstand the working and test pressures and velocities. Locate wells to sense continuous flow conditions. Do not install wells using extension couplings. Where piping diameters are smaller than the length of the wells, provide wells in the piping at elbows to effect proper flow across the entire area of the well. Wells may either look upstream or downstream. Provide thermal transmission material within the well to speed the response of temperature measurement. Provide wells with sealing nuts to contain the thermal transmission material and allow for easy removal. Wells shall not restrict flow area to less than 70 percent of line-size-pipe normal flow area. Increase piping size as required to avoid restriction.

3.3 ADJUSTMENTS

- A. Adjust controls and equipment to maintain the conditions indicated, to perform the functions indicated, and to operate in the sequence specified.

3.4 INSTRUCTING OPERATING PERSONNEL

- A. Upon completion of the work and when designated by the Architect, furnish the services of a competent technician regularly employed by the temperature control manufacturer for the instruction of Owner in the operation and maintenance of each automatic space temperature control system. The period of instruction shall be for not less than one 8 hour period and shall include video tape demonstration of controllers.

3.5 FIELD INSPECTION AND TESTS

- A. Tests shall be performed or supervised by employees of the ATC system or manufacturer of the ATC system, or by an authorized representative of the ATC manufacturer. Give Architect 14 calendar days advance written notice prior to the date of the field acceptance testing. If the Architect witnesses tests, such tests shall be subject to approval. If the Architect does not witness tests, provide performance certification.
- B. Plan for Inspections and Tests: Furnish a written inspections and tests plan at least 60 days prior to the field acceptance test date. This plan shall be developed by the manufacturer of the ATC system. The plan shall delineate the inspections and testing procedures required for the ATC system to demonstrate compliance with the requirements specified. Additionally, the test plan shall indicate how ATC system is to be tested, what variables will be monitored during test, names of individuals performing tests, and what criteria for acceptance should be used. Indicate how operation of H&V system and ATC system in each seasonal condition will be simulated.
- C. Field Acceptance Testing: Upon completion of 72 hours of continuous H&V and ATC systems operation and before final acceptance of work, test the automatic temperature control systems in service with the heating, ventilating and air conditioning systems to demonstrate compliance with contract requirements. Test controls through each cycle of operation, including simulation of each season insofar as possible. Test safety controls to demonstrate performance of required function. Adjust or repair defective or malfunctioning automatic space temperature control equipment or replace with new equipment. Repeat tests to demonstrate compliance with contract requirements.

\* END OF SECTION \*

SECTION 23 30 00

DUCTWORK AND ACCESSORIES

PART 1 GENERAL

1.1 RELATED DOCUMENTS

- A. The drawings and the specifications including Section 23 05 00 "Supplemental Mechanical General Requirements" are hereby made a part of the work of this section.
- B. Drawings and general provisions of Contract including General and Supplementary Conditions and all Division 1 specification sections.
- C. Provision of waste management: Section 01 74 19, Construction Waste Management and Disposal.
- D. Ductwork shall be protected from dirt and debris in accordance with SMACNA Standard "Duct Cleanliness for New Construction".
- F. Coordinate with Section 01 20 00 Price And Payment Procedures.

1.2 DESCRIPTION OF WORK

- A. The work covered by this Section of the specifications includes the furnishing of labor, materials, equipment, transportation, permits, inspections and incidentals and the performing of operations required to install the ductwork systems indicated.

1.3 SUBMITTALS

- A. Substitutions: Your attention is directed to Section 23 05 00-"Substitutions", relative to competition and the (ONLY) notation. Familiarity with this section should be achieved before reading the PRODUCTS section of this specification.
- B. The items for which the submittals paragraph in Section 23 05 00, Supplemental General Mechanical Requirements, apply are as follows:
  - 1. Ductwork.
  - 2. Ductwork accessories.
  - 3. Firestopping materials and methods.
  - 4. Ductwork sealing products.
  - 5. Combination fire / smoke dampers.
  - 6. Louvers and brick vents.
  - 7. Grilles, registers and diffusers.
- C. Section 01 33 00 - Submittal Procedures: Submittal procedures.
- D. Product Data: Submit data on product characteristics, performance criteria and limitations.

- E. Manufacturer's Installation Instructions: Submit procedure for preparation and installation.
- F. Manufacturer's Certificate: Certify products meet or exceed specified requirements.

## PART 2 PRODUCTS

### 2.1 DUCTWORK

- A. Classification of Ductwork: Low pressure ductwork: up to 2" W.G. static pressure.
- B. Materials: Unless otherwise indicated low pressure ductwork shall be galvanized steel. Galvanized sheet metal shall be new galvanized steel sheets of lock forming quality with zinc coating that will not flake or peel under forming operation.
- C. Construction for Low Pressure Round and Rectangular Ductwork:
  - 1. Material: Galvanized steel conforming to ASTM A527, weight of galvanized coating shall be not less than 1-1/4 ounces total for both sides of one sq.ft. of a sheet. Construction, metal gage, and reinforcements shall conform with SMACNA "Duct Construction Standards" and NFPA 90A for 2" W.G. pressure class.
  - 2. Fittings: Shall be constructed in accordance with SMACNA Standards and shall be of the types indicated (ONLY).
  - 3. Longitudinal joints shall be Pittsburgh lockseam (ONLY). Button punch snap locks are not acceptable.
  - 4. Joints shall be sealed to SMACNA seal class B.

### 2.2 DUCTWORK ACCESSORIES

- A. Access Doors: Ruskin Model ADC2, 12"x12" size, 24 gauge galvanized steel, steel on both sides of door, foam gasket seals, 1" insulation, 2 cam locks, no hinge.
- B. Backdraft Dampers (BDD): Ruskin Model CBD2 or American Warming and Ventilating aluminum frame and blades, extruded vinyl edge seals, field set at 0.10" W.G. pressure differential for full open operation.
- C. Flexible Duct Connections: Ventfabrics, Inc. neoprene coated glass fabric. Provide flexible connections at all air handling equipment, e.g. ERV's, unless equipment is furnished with integral flexible connectors.
- D. Drawbands for Flexible Ducts: Clinch type stainless steel with screwdriver adjustment, or nylon with lever action tightening tool provided by the drawband manufacturer.
- E. Turning Vanes: (Low Pressure):

1. Solid blade, mounted with the long edge down stream in accordance with duct construction details indicated. Submit a 12"x12" sample elbow for review prior to fabrication.
- F. Volume Dampers:
1. Factory fabricated as specified, or shop fabricated in accordance with SMACNA "HVAC Duct Construction Standards".
  2. Rectangular: Ruskin Model MD-35, or American Warming and Ventilating, 12 gauge galvanized steel, locking quadrant, opposed blade over 11", single blade 11" and under.
  3. Round: Ruskin Model MDRS25, or American Warming and Ventilating, 20 gauge galvanized steel with locking quadrant(ONLY). Dampers may be provided integral with spin-in fittings.
- G. Flexible Ductwork:
1. Low Pressure Duct Systems: Wiremold type WGCF, polyester core with wire helix, 2" thick (R-6 min.), 3/4 lb fiberglass insulation, polyolefin jacket/vapor barrier, 2" W.G. rated pressure.
- H. Joint Sealer:
1. Hardcast Two-Part II DT tape with RTA-50 indoor/outdoor activator.
  2. Hardcast Duct-Seal 321 water based indoor/outdoor sealant.
- i. Fire Dampers: Greenheck FD-series, Ruskin Model IBD2, or Cesco, dynamic rated, curtain type, 100% free area (ONLY), Style C for round duct installations, and Style B for rectangular duct applications. Fire dampers located immediately behind transfer grilles may be Style A dampers. The dampers shall be UL rated for 1-1/2 hours and have a 165°F fusible link. Fire dampers shall comply with UL "Standard for Safety" 555.
- j. Acoustical duct liner for rectangular ductwork shall be Type AP Armaflex SA duct liner. The liner shall be elastomeric unicellular (closed cell) and have a thermal conductivity of 0.27 Btuh/<sup>0</sup>F.-sf-in. and be cleanable and suitable for duct velocities of 4000 FPM. Duct liner thickness shall be 1" unless indicated otherwise. The installation shall include 100% coverage of the manufacturer's recommended adhesive and protective Z-strips at all exposed upstream edges. Mechanical fasteners shall be used in addition to adhesive. Insulation shall comply with NFPA 90A and NFPA 90B and be approved by Factory Mutual. Duct dimension are net inside of liner.

#### 2.4 COMBINATION FIRE / SMOKE DAMPERS

- A. Combination fire / smoke dampers shall be Greenheck Model FSD-311, Ruskin Model FSD, or approved equal, 1½ hour rating, UL-classified, Class 1 with fusible link, actuator end switch and integral damper actuator and duct smoke detector. Blades shall be airfoil type. Dampers shall

be rated for velocities up to 2000 FPM. Provide a test switch for each damper. Installation shall be per the manufacturers recommendations including access doors for all serviceable components. Damper actuators shall be mounted outside the ductwork in an accessible location. Provide 16 gauge sheetmetal sleeves for each combination fire / smoke damper and retaining angles per the manufacturers recommendations.

- B. Provide combination fire / smoke dampers at each duct penetration thru the fire and smoke rated floor assembly. See the Architectural Drawings for additional information.

## 2.5 AIR DEVICES (Krueger, Price, Metal Aire, Titus, Seiho) ONLY

- A. Material and Finishes: Construct diffusers, registers, and grilles of steel, suitable for use with ceiling radiation dampers (CRD). Exterior and exposed edges shall be rolled, or otherwise stiffened and rounded. Steel parts shall be factory zinc-phosphate treated prior to priming and painting or have a baked-on enamel finish. Provide frame style compatible with ceiling or wall type. Colors shall be selected by Architect. Devices to be installed on exposed duct installations shall be furnished in primer suitable for field application of color coat.
- B. Sound Pressure Level: Manufacturer certified sound pressure level rating of inlets and outlets in accordance with ADC 1062 R4. Conform with the permissible room sound pressure level for each device as scheduled.
- C. Throw: Defined as distance from the diffuser, register, or grille to the point which the resultant room air velocity is 50 to 35 feet per minute.
- D. Ceiling Diffusers: Equip with core styles required to provide air distribution pattern indicated. Internal parts shall be removable through the diffuser-neck for access to the duct and without the use of special tools. Construct each diffuser of four or more concentric elements designed to deliver air in a generally horizontal direction. The interior elements of square and rectangular ceiling diffusers may be square or rectangular as manufacturer's standard. Screws or bolts in exposed face of frames or core elements are not acceptable. Diffusers shall have an opposed blade volume damper in the diffuser neck. Diffusers shall have a 24"x24" lay-in panel for areas with acoustical ceilings and surface-mount frame for GWB ceilings. Provide Ceiling Radiation Dampers (CRD) where indicated and required. CRD's will be required at all GWB ceilings.
- E. Grilles and Registers: Construction and finish as indicated, 1/2" louver spacing, 45° curved blade. Grilles and registers shall have opposed-blade volume dampers with screwdriver adjuster. Unless otherwise indicated, registers shall be provided. Provide CRD's at each ceiling penetration.
- F. General: The interior of all sheetmetal connections to grilles, registers and diffusers shall be painted with a non-specular flat black paint so that no sheetmetal surfaces are visible from the finished space. All ceiling mounted registers, grilles and diffusers shall be provided with ceiling radiation dampers.

## 2.4 FUTURE KITCHEN HOOD EXHAUST DUCTWORK

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- A. Grease duct construction shall be per the IBC and NFPA 96, continuously welded 16 gauge black carbon steel with bolted and gasketted cleanouts at each floor level and each elbow. Maintain the minimum clearance to combustibles and protect combustibles with "Firemaster" insulation per NFPA, two (2) layers, 1½" thick. Firemaster high temperature ceramic insulation will be required on all kitchen hood exhaust ductwork.

### PART 3 EXECUTION

#### 3.1 SURFACE CONDITIONS

- A. Inspection:
  - 1. Prior to work of this Section, carefully inspect the installed work of other trades and verify that such work is complete to the point where this installation may properly commence.
  - 2. Verify that the duct systems may be installed in accordance with pertinent codes and regulations and the reviewed Submittals.

#### 3.2 INSTALLATION OF DUCTWORK AND AIR DEVICES

- A. Provide and erect in accordance with the best practice of the trade ductwork shown on the drawings and as required to complete the intended installation. Make offsets as shown or required to place ductwork in proper position to avoid conflicts with other work and to allow the application of insulation and finish painting to the satisfaction of the Architect. Sizes given are "inside - clear" dimensions and not necessarily that of sheet metal. Ducts shall be arranged to adjust to "field conditions". The Sheet Metal trades shall coordinate his work with other trades. Work shall conform to ASHRAE duct construction recommendations, SMACNA "Duct Construction Standards", NFPA, and the requirements of MUBEC.
- B. Joint Sealing: See PRODUCTS section.
- C. Longitudinal joints: See PRODUCTS section.
- D. Turns shall be made with long radius elbows or, if physically impossible to use long radius elbows, shall be square turns with specified turning vanes. CAUTION: Turns not conforming to this requirement shall be ordered removed and replaced with properly built turns.
- E. Access Doors: Provide access doors for concealed apparatus requiring service and inspection in the duct system including but not limited to dampers, smoke detectors, sensors and motors, and upstream and downstream from duct coils.
- F. Duct Sleeves and Prepared Openings: Install duct sleeves and prepared openings for duct mains, duct branches, and ducts passing through walls, roofs, and ceilings. Insure the proper size and location of sleeves and prepared openings. Allow one-inch clearance between duct and sleeve or one-inch clearance between insulation and sleeve for insulated ducts, except at grilles, registers, and diffusers.

- G. Duct Supports: Unless otherwise indicated, provide one-inch wide by 16 gage galvanized steel sheet metal strips on each side of ducts. Anchor risers in the center of the vertical run to allow ends or riser free vertical movements. Attach supports only to structural framing members. Do not anchor supports to metal decking unless a means is provided (architectural review required) for preventing the anchors from puncturing the metal decking. Where supports are required between structural framing members, provide suitable intermediate metal framing. Where C clamps are used, use retainer clips.
- H. Flexible Collars and Connections: Provide flexible collars between fans and ducts or casings and where ducts are of dissimilar metals, as indicated or required. For round ducts, securely fasten flexible connections using stainless steel clinch-type draw-band. Nylon drawbands may be used if installed using the drawband manufacturer's lever-action tightening tool. For rectangular ducts, lock flexible connections to metal collars.
- I. Flexible Ducts: Provide where indicated. No fiberglass shall be in contact with air flow. Flexible duct length shall not be more than 4'-0". Install with metal band hangers and without excess length, provide maximum extension of flex duct. Securely fasten flexible ducts to metal collars using a stainless steel or tool-tightened nylon drawband on the duct core and a second drawband on the insulation vapor barrier. If the duct exceeds 12 inches diameter, position the drawband behind a bead on the metal collar. Taping in lieu of drawbands is not allowed.
- J. Any deviation in the duct system must be submitted as a shop drawing and stamped. CAUTION: Any deviation not submitted and favorably reviewed will be ordered removed from the system and replaced with that which is shown on the Drawings.
- K. Discrepancies between actual field conditions and the Contract Documents shall be brought to the attention of the Architect prior to fabrication.
- L. Field Changes to Ductwork: Field changes of ducts such as those required to suit the sizes of factory-fabricated equipment actually furnished shall be designed to minimize expansion and contraction. Use 4:1 transitions in field changes as well as modifications to connecting ducts.
- M. Transitions with a slope greater than 4 to 1 shall be ordered removed from the system and replaced with a transition which meets this criteria.
- N. Joints and seams at intake and exhaust plenums and joints on intake and exhaust ductwork for a distance of 3 feet from the plenum shall be sealed watertight on the bottom and side joints and seams.
- O. Isolation dampers at intake and exhaust louvers and vent hoods shall be sealed to the ductwork to provide an airtight assembly with similar performance characteristics to the isolation damper.

### 3.3 CLOSING IN WORK

- A. Cover up or enclose work after it has been properly and completely tested and reviewed.



- B. No additional cost to the Owner will be allowed for uncovering or recovering any work that is covered or enclosed prior to required test and review.

#### 3.4 TEST AND ADJUST

- A. Before operating any system, the system shall be cleaned out to remove dust and foreign materials.
- B. After the installation is complete and ready for operation, test the system under normal operating conditions in the presence of the Architect and demonstrate that the system functions as designed.
- C. Correct defects which develop during the test period, conduct additional testing until defect free operation is achieved.

#### 3.5 CLEANUP AND CORROSION PREVENTION

- A. Ductwork and equipment shall be thoroughly cleaned. Dirt, dust, and debris shall be removed and the premises left in a clean and neat condition.
- B. Before covering is applied to duct systems, clips, rods, clevises and other hanger attachments, and before uncovered piping is permitted to be concealed, corrosion and rust shall be wire brushed and cleaned and in the case of iron products, a coat of approved protective paint applied to these surfaces.

#### 3.6 INSTRUCTIONS

- A. On completion of the project, instruct the Owner's representative in the care and operation of the system. The total period of instruction shall not exceed four (4) hours. The time of instruction shall be arranged with the Owner. In addition to the prime Mechanical Contractor, the control system Contractor, Balancing Contractor, and Owner's representative shall be present and participate in the Owner's instruction.

#### 3.7 FIRESTOPPING

- A. Firestopping shall be performed in accordance with Specification Section 07 84 00 "Firestopping". All penetrations of fire-rated assemblies including walls and floors by mechanical system components (piping, ductwork, conduits, etc.) shall be firestopped as specified.

\* END OF SECTION \*

SECTION 260000

GENERAL ELECTRICAL REQUIREMENTS

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Basic Electrical Requirements specifically applicable to Divisions 26, 27 and 28 Sections.

1.02 REFERENCES

- A. ANSI/NFPA 70 - National Electrical Code.
- B. ANSI C2 - National Electrical Safety Code.
- C. ANSI/NFPA 101 - Life Safety Code.

1.03 RELATED REQUIREMENTS

- A. Conditions of the Contract and Division 1 - General Requirements, apply to all work, including work of this Division. Examine all contract documents for requirements affecting this work.

1.04 SUBMITTALS

- A. Submit under provisions of Division 01.
- B. Submit shop drawings and product data grouped to include complete submittals of related systems, products, and accessories in a single submittal.
- C. Mark dimensions and values in units to match those specified.
- D. Provide fixture schedule, lighting drawings, panelboard schedules and single line or risers diagram(s) to supplier for assistance in pricing as applicable. Contractor shall receive one set of black line drawings for reproduction from the engineer for this purpose.

1.05 REGULATORY REQUIREMENTS

- A. Conform to applicable local, State and Federal Building Code for the State of Maine.
- B. Electrical: Conform to NFPA 70, NFPA72, NFPA 99, NFPA 101, ANSI C2, 2 FM, UL, and applicable ASTM and ANSI Standards.
- C. Contractor shall visit the site to become familiar with all existing conditions affecting this

work. No claim shall be recognized for extra compensation due to failure of contractor to familiarize himself/herself with the conditions and extent of proposed work.

- D. Obtain permits and request inspections by local authority having jurisdiction.

1.06 PROJECT/SITE CONDITIONS

- A. Install Work in locations shown on Drawings, unless prevented by Project conditions.
- B. Prepare drawings showing proposed rearrangement of Work to meet Project conditions, including changes to Work specified in other Sections. Obtain permission of Engineer before proceeding.

1.08 TEMPORARY LIGHT AND POWER

- A. Temporary light and power shall be installed and maintained by the Electrical Contractor for use by all trades for the duration of construction complete with all wiring, switches, protective devices and similar equipment as may be required. Arrangement for the temporary service with the Power Company is the responsibility of the Electrical Contractor. Power bills will be paid by the General Contractor. Provide 120/208 volt or 120/240 volt 100 ampere, drop box similar to standard CMP detail 980-31.1.4. Provide 15-20 watt self ballasted compact fluorescent, lamps with plastic "cages" as needed. or 4 foot twin lamp (T8) fluorescent tamper-proof, gasketed and water-tight as required.

1.09 CONTRACT DRAWINGS AND SPECIFICATIONS

- A. It is to be understood that drawings accompanying these specifications are intended to show general arrangement and extent of work to be done, but exact location and arrangement of all components shall be determined as work progresses. Anything shown on the drawings and not specifically mentioned in specifications or vice versa shall be considered as required in both.
- B. Locations of equipment, and materials, etc., as given on drawings are approximate unless dimensioned. It shall be understood they are subject to such modifications as may be found necessary or desirable at time of installation in order to meet any structural conditions. Such changes shall be made by the contractor without extra charges.
- C. Because of small scale drawings, all required offsets, etc., as may be required to clear work of other Contractors, may not be shown. Contractor, however, shall provide all necessary offsets, etc., as required to complete the installation of their work and not conflict with that of others.
- D. It is the intention that wiring systems shall be complete and fully operational. The contractor shall identify system components during the bid process that clearly constitute conditions that would cause the system to be incomplete. Clarification: The remedy to these discrepancies shall be communicated by the engineer to all bidders or included as an addenda.

1.10 MATERIALS AND LABOR

- A. Bidders for this work shall carefully examine the Plans and Specifications, as the Contractor shall be required to furnish all materials and labor necessary to deliver to the Owner a complete system installed in full accordance with Local State and Federal laws. The system shall be furnished as specified, tested, and turned over to the Owner in perfect operating condition.
- B. All materials shall be new and of best quality of their respective kinds. Workmanship in all respects shall be of highest grade and all construction shall be done according to best practices of the trade. Materials shall be warrantied directly by the manufacturer.
- C. Contractor shall provide, when required for review of Engineer, labeled samples of any material or equipment specified herein or proposed to be used on this project.
- D. Where words "furnish", "provide" or "install" are mentioned, either singly or in combination, these words are hereby interpreted to mean "furnish and install" or "provide and install," including all materials complete with all connections, supplemental devices, accessories and appurtenances, unless specifically otherwise noted. These words are likewise hereby interpreted as being prefixed to all materials, equipment, and apparatus hereinafter mentioned, either in abbreviated or schedule information.

1.11 PROTECTION OF WORK AND MATERIALS

- A. Contractors shall be responsible for the care and protection of all materials delivered and labor performed until the completion of the work.
- B. Cap all uncompleted lines, raceways, and ducts until ready for final connections, or future work as indicated.
- C. All portions of the work liable to damage by weather or by those engaged on the project, must be securely protected by temporary, but substantial covering which must be maintained in position until Engineer authorizes removal.

1.12 REPLACEMENTS

- A. In the event of damage to any equipment or materials, immediately make all repairs and replacements necessary to the approval of the Engineer at no additional cost to the Owner.

1.13 SAFETY REGULATIONS

- A. All work to be performed and/or installed shall conform to all requirements of the Occupational Safety and Health Act (OSHA) of 1970 and all Amendments thereto.

1.14 INSURANCE

- A. The Contractor shall purchase and maintain all Workmen's Compensation Insurance, Public Liability and Property Damage Insurance during the progress of the work and until completion and acceptance of the entire project by the Owner.

1.15 QUALITY ASSURANCE/CONTROL OF INSTALLATION

- A. Monitor quality control over suppliers, manufacturers, Products, services, site conditions, and workmanship, to produce Work of specified quality.
- B. Comply fully with manufacturers' instructions, including each step in sequence.
- C. Should manufacturers' instructions conflict with Contract Documents, request clarification from Engineer before proceeding.
- D. Comply with specified standards as a minimum quality for the Work except when more stringent tolerances, codes, or specified requirements indicate higher standards or more precise workmanship.
- E. Perform work using persons qualified to produce workmanship of specified quality.
- F. Secure Products in place with positive anchorage devices designed and sized to withstand stresses, vibration, and physical distortion or disfigurement.

1.16 UNDERWRITER'S APPROVALS

- A. All electrical materials and equipment shall bear label of Underwriter's Laboratories, shall be listed by them in their list of electrical fittings and shall be approved by them for purpose for which they are to be used, unless materials and equipment are of a type for which Underwriter's Laboratories does not list or provide label service.

1.17 SUBSTITUTIONS

- A. Where the specifications allow the substitution of a product for that which has been specified, said substitution must be reviewed by the Engineer and shall be equivalent in all respects to that which is specified. The Engineer's decision shall be obtained on all questions as follows, and his/her judgment shall be final and binding on all parties.
- B. Reference in the specifications or on the drawings to any product, material, fixture, form or type of construction, etc., by proprietary name, manufacturer, make or catalog number, shall be interpreted as establishing a standard of quality or design and shall not be construed as limiting competition. The Contractor may, at his/her option, use any fully equivalent substitute provided written review by the Engineer is first obtained indicating acceptance of the equality of the substitute preferred.
- C. For materials or equipment which are supplied with integral or factory applied finish, the colors of same shall be considered in evaluating substitutions.

- D. For the purpose of avoiding conflicts with other trades, contracts, and adjoining work where more than one (1) article, device, material, fixture, form or type of construction, etc., is referred to by proprietary name, manufacturer, make or catalog number, the first named shall be used as the basis of design and details. The cost of any changes of approved equivalent item shall be borne by the Contractor requesting such change.

1.18 RECORD DRAWINGS

- A. During construction, the Contractor shall keep an accurate record of all deviations to the installation of the work as indicated on the drawings. Upon completion of the work, the Contractor shall furnish a copy of this record to the Engineer, on a black line of the original which will be available from the Engineer. Submit record drawings before requesting final payment.

1.19 MANUFACTURER'S REPRESENTATIVE

- A. At appropriate times, or as directed by the Engineer, provide the services of a competent factory trained Engineer or Technician of the particular manufacturer of equipment or item involved, to inspect, adjust, and place in proper operating condition any and all such items of manufacture. No additional compensation shall be allowed Contractors for such service.

1.20 MANUFACTURERS' INSTRUCTIONS, AND OPERATION AND MAINTENANCE DATA

- A. Provide for each item of equipment or apparatus furnished, a complete set of printed instructions obtained from the manufacturer covering proper operation, care, lubrication, cleaning, servicing, adjustment, etc., together with any special safety instructions.
- B. Manufacturers' data shall further include performance data (time current curves, where applicable), complete parts lists, recommended spare parts lists, and wiring diagrams.
- C. Data shall be arranged in complete sets, properly indexed and marked.
- D. Data shall include complete set of shop drawings.
- E. Material shall first be submitted in preliminary fashion for review by Engineer. After approval, Contractor shall submit two (2) copies in bound volumes to the Engineer for distribution.
- F. Provide contacts for service agencies for all major system components.

1.21 GUARANTEES

- A. An item becomes "defective" when it ceases to conform to this Contract Document. Guarantees beginning on the date of issuance of the Owner's final payment, or certificate of substantial completion, with Owner taking occupancy or beneficial use thereafter.
- B. Upon completion of the work and before applying for final payment, furnish a written guarantee, stating that the work complies with the provisions of codes listed herein and the

local enforcing authorities, and that it will be free from defects of material and workmanship for the required guarantee period. Guarantee shall further state that the Contractor will, at his own expense, repair and/or replace any of his material and work which may become defective during the time of guarantee, together with other work damaged as a consequence of such defects. All manufacturers written warranties shall apply to materials. Warranties other than that of the manufacturer are not acceptable.

- C. The guarantee period shall be one (1) year except when longer periods are indicated for specific equipment.
- D. All materials in Division 26 where a written warranty is published shall require the warranty to be offered by the product manufacturer.

#### 1.22 EXISTING UTILITIES AND EQUIPMENT

- A. Extreme care shall be taken to protect existing utilities and equipment above and below grade and in all other locations. Information contained on drawings is not guaranteed as to location, invert, etc. but represent the best information available as to the location of underground and concealed utilities and equipment. The Contractor shall be responsible for the replacement of all damaged or broken utilities or equipment due to their work or operations.

#### 1.23 ENERGIZING EQUIPMENT

- A. Obtain Owner's written approval before energizing any equipment.

### PART 2 PRODUCTS

Not used.

### PART 3 EXECUTION

#### 3.01 CONNECTION TO EQUIPMENT

- A. The Contractor shall be responsible for proper wiring and raceway connections to equipment, make sure of alignment, both initially and under operating conditions, and provide proper supports, brackets, means of expansion, etc., to make sure that no excessive stresses are applied to equipment. Raceways shall be run to the equipment and alignment checked before final bolting and fastening.
- B. At the request of the Engineer, dismantle equipment connections to demonstrate proper installation and make such corrections necessary without additional compensation for disassembly, re-connection, or the required corrective work.
- C. Equipment shall be installed in such a manner as to permit disconnecting for service and repairs without the necessity of rigging.

3.02 CLOSING IN UNINSPECTED WORK

- A General: Do not cover up or enclose work until it has been properly and completely inspected and approved. Engineer may waive this requirement by written permission.
- B Noncompliance: Should any of the work be covered up or enclosed prior to all required inspections and approvals, uncover the work as required, and after it has been completely inspected and approved, make all repairs and replacements with such materials as are necessary to the approval of the Engineer and at no additional cost to the Owner.

3.03 CLEANING OF SYSTEMS

- A All wiring systems shall be thoroughly cleaned prior to initial operation and in accordance with manufacturer's instructions for equipment to be furnished and/or installed.
- B Furnish all detergents, solvents, cleaning compounds, tools, etc., required in connection with cleaning operations.
- C Thoroughly clean all exposed portions of all equipment, remove all labels, and wipe clean with a damp rag.

3.04 TESTING, BALANCING, AND ADJUSTING

- A Electrical loads shall be balanced on all phase legs to a tolerance of plus or minus 10 percent. Include testing circuits for shorts to ground. Measure grounding system resistance. Correct all deficiencies. Provide all test equipment.

3.05 INSTRUCTIONS

- A On completion of the job, Contractor shall provide competent technicians to thoroughly instruct the Owner's representative in the care and operation of the system. The total period of instruction shall not exceed 2 hours and be performed in a minimum of one interval. The time of instruction shall be arranged with the Owner. The Electrical subcontractor shall be present and participate in the Owner's instruction.

3.06 FIRESTOPPING

- A Firestopping shall be performed in accordance with Specification Section "Firestopping". All penetrations of fire-rated assemblies including walls and floors by electrical system components (conduits, cables, trays, etc.) shall be firestopped as specified. Coordinate size, location and type of sleeves as required by firestopping systems.

\*\*\* END OF SECTION \*\*\*



SECTION 260519 - LOW-VOLTAGE ELECTRICAL POWER CONDUCTORS AND CABLES

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. Building wires and cables rated 600 V and less.
  - 2. Connectors, splices, and terminations rated 600 V and less.
- B. Related Requirements:
  - 1. Section 271500 "Communications Horizontal Cabling" for cabling used for voice and data circuits.

1.3 ACTION SUBMITTALS

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

PART 2 - PRODUCTS

2.1 CONDUCTORS AND CABLES

- A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
  - 1. General Cable Technologies Corporation.
  - 2. Southwire Incorporated.
  - 3. The Okonite Company.
- B. Copper Conductors: Comply with NEMA WC 70/ICEA S-95-658.
- C. Conductor Insulation: Comply with NEMA WC 70/ICEA S-95-658 for Type THHN-2-THWN-2.
- D. Multiconductor Cable: Comply with NEMA WC 70/ICEA S-95-658 for Metal Clad cable, Type MC or SO cable.

## 2.2 CONNECTORS AND SPLICES

- A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
  - 1. AFC Cable Systems, Inc.
  - 2. Gardner Bender.
  - 3. Hubbell Power Systems, Inc.
  - 4. Ideal Industries, Inc.
  - 5. IlSCO; a branch of Bardes Corporation.
  - 6. NSi Industries LLC.
  - 7. O-Z/Gedney; a brand of the EGS Electrical Group.
  - 8. 3M; Electrical Markets Division.
  - 9. Tyco Electronics.
  
- B. Description: Factory-fabricated connectors and splices of size, ampacity rating, material, type, and class for application and service indicated.

## 2.3 SYSTEM DESCRIPTION

- A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
  
- B. Comply with NFPA 70.

## PART 3 - EXECUTION

### 3.1 CONDUCTOR MATERIAL APPLICATIONS

- A. Feeders: Copper. Solid for No. 10 AWG and smaller; stranded for No. 8 AWG and larger.
  
- B. Branch Circuits: Copper. Solid for No. 12 AWG and smaller; stranded for No. 10 AWG and larger.

### 3.2 CONDUCTOR INSULATION AND MULTICONDUCTOR CABLE APPLICATIONS AND WIRING METHODS

- A. Service Entrance: Type THHN-2-THWN-2, single conductors in raceway.
  
- B. Feeders: Type THHN-2-THWN-2, single conductors in raceway.
  
- C. Exposed Branch Circuits, Including in Crawlspace: Type THHN-2-THWN-2, single conductors in raceway.
  
- D. Branch Circuits Concealed in Ceilings, Walls, and Partitions: Metal Clad Cable, Type MC.

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- E. Branch Circuits Concealed in Concrete, below Slabs-on-Grade, and Underground: Type THHN-2-THWN-2, single conductors in raceway.
- F. Cord Drops and Portable Appliance Connections: Type SO, hard service cord with stainless-steel, wire-mesh, strain relief device at terminations to suit application.

### 3.3 INSTALLATION OF CONDUCTORS AND CABLES

- A. Conceal cables in finished walls, ceilings, and floors unless otherwise indicated.
- B. Complete raceway installation between conductor and cable termination points according to Section "Raceways and Boxes for Electrical Systems" prior to pulling conductors and cables.
- C. Use manufacturer-approved pulling compound or lubricant where necessary; compound used must not deteriorate conductor or insulation. Do not exceed manufacturer's recommended maximum pulling tensions and sidewall pressure values.
- D. Use pulling means, including fish tape, cable, rope, and basket-weave wire/cable grips that will not damage cables or raceway.
- E. Install exposed cables parallel and perpendicular to surfaces of exposed structural members, and follow surface contours where possible.

### 3.4 CONNECTIONS

- A. Tighten electrical connectors and terminals according to manufacturer's published torque-tightening values. If manufacturer's torque values are not indicated, use those specified in UL 486A-486B.
- B. Make splices, terminations, and taps that are compatible with conductor material.
- C. Wiring at Outlets: Install conductor at each outlet, with at least 6 inches of slack.

### 3.5 IDENTIFICATION

- A. Identify and color-code conductors and cables according to Section "Identification for Electrical Systems."
- B. Identify each spare conductor at each end with identity number and location of other end of conductor, and identify as spare conductor.

### 3.6 FIELD QUALITY CONTROL

- A. Perform the following tests and inspections:

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1. After installing conductors and cables and before electrical circuitry has been energized, test service entrance and feeder conductors for compliance with requirements.
  2. Perform each visual and mechanical inspection and electrical test stated in NETA Acceptance Testing Specification. Certify compliance with test parameters.
- B. Test and Inspection Reports: Prepare a written report to record the following:
1. Procedures used.
  2. Results that comply with requirements.
  3. Results that do not comply with requirements and corrective action taken to achieve compliance with requirements.
- C. Cables will be considered defective if they do not pass tests and inspections.

END OF SECTION 260519

SECTION 260526 - GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS

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: Grounding systems and equipment.
- B. Section includes grounding systems and equipment, plus the following special applications:
  - 1. Underground distribution grounding.

1.3 ACTION SUBMITTALS

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

1.4 QUALITY ASSURANCE

- A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- B. Comply with UL 467 for grounding and bonding materials and equipment.

PART 2 - PRODUCTS

2.1 CONDUCTORS

- A. Insulated Conductors: Copper or tinned-copper wire or cable insulated for 600 V unless otherwise required by applicable Code or authorities having jurisdiction.
- B. Bare Copper Conductors:
  - 1. Solid Conductors: ASTM B 3.
  - 2. Stranded Conductors: ASTM B 8.
  - 3. Tinned Conductors: ASTM B 33.
  - 4. Bonding Cable: 28 kcmil, 14 strands of No. 17 AWG conductor, 1/4 inch (6 mm) in diameter.

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5. Bonding Conductor: No. 4 or No. 6 AWG, stranded conductor.
  6. Bonding Jumper: Copper tape, braided conductors terminated with copper ferrules; 1-5/8 inches (41 mm) wide and 1/16 inch (1.6 mm) thick.
  7. Tinned Bonding Jumper: Tinned-copper tape, braided conductors terminated with copper ferrules; 1-5/8 inches (41 mm) wide and 1/16 inch (1.6 mm) thick.
- C. Grounding Bus: Predrilled rectangular bars of annealed copper, 1/4 by 4 inches (6.3 by 100 mm) in cross section, with 9/32-inch (7.14-mm) holes spaced 1-1/8 inches (28 mm) apart. Stand-off insulators for mounting shall comply with UL 891 for use in switchboards, 600 V. Lexan or PVC, impulse tested at 5000 V.

### 2.2 CONNECTORS

- A. Listed and labeled by an NRTL acceptable to authorities having jurisdiction for applications in which used and for specific types, sizes, and combinations of conductors and other items connected.
- B. Bolted Connectors for Conductors and Pipes: Copper or copper alloy, pressure type with at least two bolts.
  1. Pipe Connectors: Clamp type, sized for pipe.
- C. Welded Connectors: Exothermic-welding kits of types recommended by kit manufacturer for materials being joined and installation conditions.
- D. Bus-bar Connectors: Mechanical type, cast silicon bronze, solderless compression-type wire terminals, and long-barrel, two-bolt connection to ground bus bar.

### 2.3 GROUNDING ELECTRODES

- A. Ground Rods: Copper-clad steel; 3/4 inch by 10 feet.
  1. Termination: Factory-attached No. 4/0 AWG bare conductor at least 48 inches (1200 mm) long.
  2. Backfill Material: Electrode manufacturers recommended material.

## PART 3 - EXECUTION

### 3.1 APPLICATIONS

- A. Conductors: Install solid conductor for No. 8 AWG and smaller, and stranded conductors for No. 6 AWG and larger unless otherwise indicated.
- B. Underground Grounding Conductors: Install bare tinned-copper conductor, No. 2/0 AWG minimum.

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1. Bury at least 24 inches (600 mm) below grade.
  2. Duct-Bank Grounding Conductor: Bury 12 inches (300 mm) above duct bank when indicated as part of duct-bank installation.
- C. Grounding Bus: Install in electrical and telephone equipment rooms, in rooms housing service equipment, and elsewhere as indicated.
1. Install bus on insulated spacers 2 inches (50 mm) minimum from wall, 6 inches (150 mm) above finished floor unless otherwise indicated.
  2. Where indicated on both sides of doorways, route bus up to top of door frame, across top of doorway, and down to specified height above floor; connect to horizontal bus.
- D. Conductor Terminations and Connections:
1. Pipe and Equipment Grounding Conductor Terminations: Bolted connectors.
  2. Underground Connections: Welded connectors except at test wells and as otherwise indicated.
  3. Connections to Ground Rods at Test Wells: Bolted connectors.
  4. Connections to Structural Steel: Welded connectors.

### 3.2 GROUNDING UNDERGROUND DISTRIBUTION SYSTEM COMPONENTS

- A. Comply with IEEE C2 grounding requirements.
- A. Install insulated equipment grounding conductors with all feeders and branch circuits.
- B. Air-Duct Equipment Circuits: Install insulated equipment grounding conductor to duct-mounted electrical devices operating at 120 V and more, including air cleaners, heaters, dampers, humidifiers, and other duct electrical equipment. Bond conductor to each unit and to air duct and connected metallic piping.
- C. Water Heater, Heat-Tracing, and Antifrost Heating Cables: Install a separate insulated equipment grounding conductor to each electric water heater and heat-tracing cable. Bond conductor to heater units, piping, connected equipment, and components.
- D. Metal Poles Supporting Outdoor Lighting Fixtures: Install grounding electrode and a separate insulated equipment grounding conductor in addition to grounding conductor installed with branch-circuit conductors.

### 3.4 INSTALLATION

- A. Grounding Conductors: Route along shortest and straightest paths possible unless otherwise indicated or required by Code. Avoid obstructing access or placing conductors where they may be subjected to strain, impact, or damage.
- B. Ground Rods: Drive rods until tops are 2 inches (50 mm) below finished floor or final grade unless otherwise indicated.

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1. Interconnect ground rods with grounding electrode conductor below grade and as otherwise indicated. Make connections without exposing steel or damaging coating if any.
  2. For grounding electrode system, install at least three rods spaced at least one-rod length from each other and located at least the same distance from other grounding electrodes, and connect to the service grounding electrode conductor.
- C. Bonding Straps and Jumpers: Install in locations accessible for inspection and maintenance except where routed through short lengths of conduit.
1. Bonding to Structure: Bond straps directly to basic structure, taking care not to penetrate any adjacent parts.
  2. Bonding to Equipment Mounted on Vibration Isolation Hangers and Supports: Install bonding so vibration is not transmitted to rigidly mounted equipment.
  3. Use exothermic-welded connectors for outdoor locations; if a disconnect-type connection is required, use a bolted clamp.
- D. Grounding and Bonding for Piping:
1. Metal Water Service Pipe: Install insulated copper grounding conductors, in conduit, from building's main service equipment, or grounding bus, to main metal water service entrances to building. Connect grounding conductors to main metal water service pipes; use a bolted clamp connector or bolt a lug-type connector to a pipe flange by using one of the lug bolts of the flange. Where a dielectric main water fitting is installed, connect grounding conductor on street side of fitting. Bond metal grounding conductor conduit or sleeve to conductor at each end.
  2. Water Meter Piping: Use braided-type bonding jumpers to electrically bypass water meters. Connect to pipe with a bolted connector.
- E. Bonding Interior Metal Ducts: Bond metal air ducts to equipment grounding conductors of associated fans, blowers, electric heaters, and air cleaners. Install bonding jumper to bond across flexible duct connections to achieve continuity.
- 3.5 LABELING
- A. Comply with requirements in Section 260553 "Identification for Electrical Systems" for instruction signs. The label or its text shall be green.
- 3.6 FIELD QUALITY CONTROL
- A. Perform tests and inspections.
1. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect components, assemblies, and equipment installations, including connections, and to assist in testing.
- B. Tests and Inspections:



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1. After installing grounding system but before permanent electrical circuits have been energized, test for compliance with requirements.
  2. Inspect physical and mechanical condition. Verify tightness of accessible, bolted, electrical connections with a calibrated torque wrench according to manufacturer's written instructions.
- C. Grounding system will be considered defective if it does not pass tests and inspections.
- D. Prepare test and inspection reports.
- E. Report measured ground resistances that exceed the following values:
1. Power and Lighting Equipment or System with Capacity of 500 kVA and less: 10 ohms.
- F. Excessive Ground Resistance: If resistance to ground exceeds specified values, notify Architect promptly and include recommendations to reduce ground resistance.

END OF SECTION 260526

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### SECTION 260533 - RACEWAYS AND BOXES FOR ELECTRICAL SYSTEMS

#### 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. Metal conduits, tubing, and fittings.
  - 2. Boxes, enclosures, and cabinets.

##### 1.3 DEFINITIONS

- A. GRC: Galvanized rigid steel conduit.

##### 1.4 ACTION SUBMITTALS

- A. Product Data: For surface raceways, wireways and fittings, floor boxes, hinged-cover enclosures, and cabinets.

#### PART 2 - PRODUCTS

##### 2.1 METAL CONDUITS, TUBING, AND FITTINGS

- A. Listing and Labeling: Metal conduits, tubing, and fittings shall be listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- B. GRC: Comply with ANSI C80.1 and UL 6.
- C. EMT: Comply with ANSI C80.3 and UL 797.
- D. FMC: Comply with UL 1; zinc-coated steel or aluminum.
- E. LFMC: Flexible steel conduit with PVC jacket and complying with UL 360.
- F. Fittings for Metal Conduit: Comply with NEMA FB 1 and UL 514B.
  - 1. Fittings for EMT:

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- a. Material: Steel or die cast.
  - b. Type: Setscrew.
- G. Joint Compound for GRC: Approved, as defined in NFPA 70, by authorities having jurisdiction for use in conduit assemblies, and compounded for use to lubricate and protect threaded conduit joints from corrosion and to enhance their conductivity.

### 2.2 BOXES, ENCLOSURES, AND CABINETS

- A. General Requirements for Boxes, Enclosures, and Cabinets: Boxes, enclosures, and cabinets installed in wet locations shall be listed for use in wet locations.
- B. Sheet Metal Outlet and Device Boxes: Comply with NEMA OS 1 and UL 514A.
- C. Cast-Metal Outlet and Device Boxes: Comply with NEMA FB 1, aluminum, Type FD, with gasketed cover.
- D. Metal Floor Boxes:
- 1. Material: Cast metal.
  - 2. Type: Fully adjustable.
  - 3. Shape: Rectangular.
  - 4. Listing and Labeling: Metal floor boxes shall be listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- E. Luminaire Outlet Boxes: Nonadjustable, designed for attachment of luminaire weighing 50 lb (23 kg). Outlet boxes designed for attachment of luminaires weighing more than 50 lb (23 kg) shall be listed and marked for the maximum allowable weight.
- F. Small Sheet Metal Pull and Junction Boxes: NEMA OS 1.
- G. Cast-Metal Access, Pull, and Junction Boxes: Comply with NEMA FB 1 and UL 1773, cast aluminum with gasketed cover.
- H. Box extensions used to accommodate new building finishes shall be of same material as recessed box.
- I. Device Box Dimensions: 4 inches square by 2-1/8 inches deep (100 mm square by 60 mm deep).
- J. Gangable boxes are allowed.
- K. Hinged-Cover Enclosures: Comply with UL 50 and NEMA 250, Type 3R with continuous-hinge cover with flush latch unless otherwise indicated.
- 1. Metal Enclosures: Steel, finished inside and out with manufacturer's standard enamel.
  - 2. Interior Panels: Steel; all sides finished with manufacturer's standard enamel.

**PART 3 - EXECUTION**

**3.1 RACEWAY APPLICATION**

- A. Outdoors: Apply raceway products as specified below unless otherwise indicated:
  - 1. Exposed Conduit: GRC.
  - 2. Concealed Conduit, Aboveground: GRC.
  - 3. Connection to Vibrating Equipment (Including Transformers and Hydraulic, Pneumatic, Electric Solenoid, or Motor-Driven Equipment): FMC.
  - 4. Boxes and Enclosures, Aboveground: NEMA 250, Type 3R.
  
- B. Indoors: Apply raceway products as specified below unless otherwise indicated:
  - 1. Exposed: EMT.
  - 2. Concealed in Ceilings and Interior Walls and Partitions: EMT.
  - 3. Connection to Vibrating Equipment (Including Transformers and Hydraulic, Pneumatic, Electric Solenoid, or Motor-Driven Equipment): FMC, except use LFMC in damp or wet locations.
  - 4. Damp or Wet Locations: GRC.
  - 5. Boxes and Enclosures: NEMA 250, Type 1, except use NEMA 250, Type 4 stainless steel in damp or wet locations.
  
- C. Minimum Raceway Size: 3/4-inch (21-mm) trade size.
  
- D. Raceway Fittings: Compatible with raceways and suitable for use and location.
  - 1. Rigid Steel Conduit: Use threaded rigid steel conduit fittings unless otherwise indicated. Comply with NEMA FB 2.10.
  - 2. EMT: Use setscrew, steel fittings. Comply with NEMA FB 2.10.
  - 3. Flexible Conduit: Use only fittings listed for use with flexible conduit. Comply with NEMA FB 2.20.

**3.2 INSTALLATION**

- A. Comply with NECA 1 and NECA 101 for installation requirements except where requirements on Drawings or in this article are stricter. Comply with NECA 102 for aluminum conduits. Comply with NFPA 70 limitations for types of raceways allowed in specific occupancies and number of floors.
  
- B. Keep raceways at least 6 inches (150 mm) away from parallel runs of flues and steam or hot-water pipes. Install horizontal raceway runs above water and steam piping.
  
- C. Complete raceway installation before starting conductor installation.
  
- D. Arrange stub-ups so curved portions of bends are not visible above finished slab.

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- E. Install no more than the equivalent of three 90-degree bends in any conduit run except for control wiring conduits, for which fewer bends are allowed. Support within 12 inches (300 mm) of changes in direction.
- F. Conceal conduit and EMT within finished walls, ceilings, and floors unless otherwise indicated. Install conduits parallel or perpendicular to building lines.
- G. Support conduit within 12 inches (300 mm) of enclosures to which attached.
- H. Stub-ups to Above Recessed Ceilings:
  - 1. Use EMT for raceways.
  - 2. Use a conduit bushing or insulated fitting to terminate stub-ups not terminated in hubs or in an enclosure.
- I. Threaded Conduit Joints, Exposed to Wet, Damp, Corrosive, or Outdoor Conditions: Apply listed compound to threads of raceway and fittings before making up joints. Follow compound manufacturer's written instructions.
- J. Raceway Terminations at Locations Subject to Moisture or Vibration: Use insulating bushings to protect conductors including conductors smaller than No. 4 AWG.
- K. Terminate threaded conduits into threaded hubs or with locknuts on inside and outside of boxes or cabinets. Install bushings on conduits up to 1-1/4-inch (35mm) trade size and insulated throat metal bushings on 1-1/2-inch (41-mm) trade size and larger conduits terminated with locknuts. Install insulated throat metal grounding bushings on service conduits.
- L. Install raceways square to the enclosure and terminate at enclosures with locknuts. Install locknuts hand tight plus 1/4 turn more.
- M. Do not rely on locknuts to penetrate nonconductive coatings on enclosures. Remove coatings in the locknut area prior to assembling conduit to enclosure to assure a continuous ground path.
- N. Cut conduit perpendicular to the length. For conduits 2-inch (53-mm) trade size and larger, use roll cutter or a guide to make cut straight and perpendicular to the length.
- O. Install pull wires in empty raceways. Use polypropylene or monofilament plastic line with not less than 200-lb (90-kg) tensile strength. Leave at least 12 inches (300 mm) of slack at each end of pull wire. Cap underground raceways designated as spare above grade alongside raceways in use.
- P. Flexible Conduit Connections: Comply with NEMA RV 3. Use a maximum of 72 inches (1830 mm) of flexible conduit for equipment subject to vibration, noise transmission, or movement; and for transformers and motors.
  - 1. Use LFMC in damp or wet locations subject to severe physical damage.

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- Q. Mount boxes at heights indicated on Drawings. If mounting heights of boxes are not individually indicated, give priority to ADA requirements. Install boxes with height measured to center of box unless otherwise indicated.
- R. Horizontally separate boxes mounted on opposite sides of walls so they are not in the same vertical channel.
- S. Locate boxes so that cover or plate will not span different building finishes.
- T. Support boxes of three gangs or more from more than one side by spanning two framing members or mounting on brackets specifically designed for the purpose.
- U. Fasten junction and pull boxes to or support from building structure. Do not support boxes by conduits.
- V. Set metal floor boxes level and flush with finished floor surface.

### 3.3 INSTALLATION OF ELECTRICAL BOXES IN FIRE RATED WALLS

- A. Outlet boxes on opposite sides of the wall shall be separated as follows:
  - 1. By a horizontal distance of not less than 24 inches (610 mm);
  - 2. By a horizontal distance of not less than the depth of the wall cavity where the wall cavity is filled with cellulose loose fill, rockwool or slag mineral wool insulation.
  - 3. By protecting both outlet boxes by listed putty pads, 3M Catalog # MPP+ or equal.
- B. Boxes exceeding 16 sq. in. (103 sq. cm) must be protected by listed putty pads, 3M Catalog # MPP+ or equal.

END OF SECTION 260533

SECTION 260553 - IDENTIFICATION FOR ELECTRICAL SYSTEMS

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. Identification for raceways.
  - 2. Identification of power and control cables.
  - 3. Identification for conductors.
  - 4. Underground-line warning tape.
  - 5. Warning labels and signs.
  - 6. Instruction signs.
  - 7. Equipment identification labels.
  - 8. Miscellaneous identification products.

1.3 ACTION SUBMITTALS

- A. Product Data: For each electrical identification product indicated.

1.4 QUALITY ASSURANCE

- A. Comply with ANSI A13.1.
- B. Comply with NFPA 70.
- C. Comply with 29 CFR 1910.144 and 29 CFR 1910.145.
- D. Comply with ANSI Z535.4 for safety signs and labels.
- E. Adhesive-attached labeling materials, including label stocks, laminating adhesives, and inks used by label printers, shall comply with UL 969.

1.5 COORDINATION

- A. Coordinate identification names, abbreviations, colors, and other features with requirements in other Sections requiring identification applications, Drawings, Shop Drawings,

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manufacturer's wiring diagrams, and the Operation and Maintenance Manual; and with those required by codes, standards, and 29 CFR 1910.145. Use consistent designations throughout Project.

- B. Coordinate installation of identifying devices with completion of covering and painting of surfaces where devices are to be applied.
- C. Coordinate installation of identifying devices with location of access panels and doors.
- D. Install identifying devices before installing acoustical ceilings and similar concealment.

## PART 2 - PRODUCTS

### 2.1 POWER AND CONTROL RACEWAY IDENTIFICATION MATERIALS

- A. Comply with ANSI A13.1 for minimum size of letters for legend and for minimum length of color field for each raceway size.
- B. Colors for Raceways Carrying Circuits at 600 V or Less:
  - 1. Black letters on an white field.
  - 2. Legend: Indicate voltage.
- C. Vinyl Labels for Raceways Carrying Circuits at 600 V or Less: Preprinted, flexible label laminated with a clear, weather- and chemical-resistant coating and matching wraparound clear adhesive tape for securing ends of legend label.
- D. Snap-Around Labels for Raceways Carrying Circuits at 600 V or Less: Slit, pretensioned, flexible, preprinted, color-coded acrylic sleeve, with diameter sized to suit diameter of raceway or cable it identifies and to stay in place by gripping action.
- E. Snap-Around, Color-Coding Bands for Raceways Carrying Circuits at 600 V or Less: Slit, pretensioned, flexible, solid-colored acrylic sleeve, 2 inches (50 mm) long, with diameter sized to suit diameter of raceway or cable it identifies and to stay in place by gripping action.
- F. Tape and Stencil for Raceways Carrying Circuits More Than 600 V: 4-inch- (100-mm-) wide black stripes on 10-inch (250-mm) centers diagonally over orange background that extends full length of raceway or duct and is 12 inches (300 mm) wide. Stop stripes at legends.

### 2.2 ARMORED AND METAL-CLAD CABLE IDENTIFICATION MATERIALS

- A. Comply with ANSI A13.1 for minimum size of letters for legend and for minimum length of color field for each cable size.
- B. Colors for Cables Carrying Circuits at 600 V and Less:
  - 1. Black letters on an white field.



2. Legend: Indicate voltage.

- C. Vinyl Labels: Preprinted, flexible label laminated with a clear, weather- and chemical-resistant coating and matching wraparound clear adhesive tape for securing ends of legend label.
- D. Self-Adhesive Vinyl Tape: Colored, heavy duty, waterproof, fade resistant; 2 inches (50 mm) wide; compounded for outdoor use.
- E. Heat-Shrink Preprinted Tubes: Flame-retardant polyolefin tube with machine-printed identification label. Sized to suit diameter of and shrinks to fit firmly around cable it identifies. Full shrink recovery at a maximum of 200 deg F (93 deg C). Comply with UL 224.

### 2.3 POWER AND CONTROL CABLE IDENTIFICATION MATERIALS

- A. Comply with ANSI A13.1 for minimum size of letters for legend and for minimum length of color field for each cable size.
- B. Vinyl Labels: Preprinted, flexible label laminated with a clear, weather- and chemical-resistant coating and matching wraparound clear adhesive tape for securing ends of legend label.
- C. Self-Adhesive, Self-Laminating Polyester Labels: Preprinted, 3-mil- (0.08-mm-) thick flexible label with acrylic pressure-sensitive adhesive that provides a clear, weather- and chemical-resistant, self-laminating, protective shield over the legend. Labels sized to fit the cable diameter such that the clear shield overlaps the entire printed legend.
- D. Heat-Shrink Preprinted Tubes: Flame-retardant polyolefin tube with machine-printed identification label. Sized to suit diameter of and shrinks to fit firmly around cable it identifies. Full shrink recovery at a maximum of 200 deg F (93 deg C). Comply with UL 224.

### 2.4 UNDERGROUND-LINE WARNING TAPE

- A. Tape:
  - 1. Recommended by manufacturer for the method of installation and suitable to identify and locate underground electrical and communications utility lines.
  - 2. Printing on tape shall be permanent and shall not be damaged by burial operations.
  - 3. Tape material and ink shall be chemically inert, and not subject to degrading when exposed to acids, alkalis, and other destructive substances commonly found in soils.
- B. Color and Printing:
  - 1. Comply with ANSI Z535.1 through ANSI Z535.5.
  - 2. Inscriptions for Red-Colored Tapes: ELECTRIC LINE.
  - 3. Inscriptions for Orange-Colored Tapes: TELEPHONE CABLE, CATV CABLE, COMMUNICATIONS CABLE.

## 2.5 WARNING LABELS AND SIGNS

- A. Comply with NFPA 70 and 29 CFR 1910.145.
- B. Self-Adhesive Warning Labels: Factory-printed, multicolor, pressure-sensitive adhesive labels, configured for display on front cover, door, or other access to equipment unless otherwise indicated.
- C. Baked-Enamel Warning Signs:
  - 1. Preprinted aluminum signs, punched or drilled for fasteners, with colors, legend, and size required for application.
  - 2. 1/4-inch (6.4-mm) grommets in corners for mounting.
  - 3. Nominal size, 7 by 10 inches (180 by 250 mm).
- D. Warning label and sign shall include, but are not limited to, the following legends:
  - 1. Multiple Power Source Warning: "DANGER - ELECTRICAL SHOCK HAZARD - EQUIPMENT HAS MULTIPLE POWER SOURCES."
  - 2. Workspace Clearance Warning: "WARNING - OSHA REGULATION - AREA IN FRONT OF ELECTRICAL EQUIPMENT MUST BE KEPT CLEAR FOR 36 INCHES (915 MM)."

## 2.6 INSTRUCTION SIGNS

- A. Engraved, laminated acrylic or melamine plastic, minimum 1/16 inch (1.6 mm) thick for signs up to 20 sq. inches (129 sq. cm) and 1/8 inch (3.2 mm) thick for larger sizes.
  - 1. Engraved legend with black letters on white face.
  - 2. Punched or drilled for mechanical fasteners.
  - 3. Framed with mitered acrylic molding and arranged for attachment at applicable equipment.
- B. Adhesive Film Label: Machine printed, in black, by thermal transfer or equivalent process. Minimum letter height shall be 3/8 inch (10 mm).

## 2.7 EQUIPMENT IDENTIFICATION LABELS

- A. Adhesive Film Label: Machine printed, in black, by thermal transfer or equivalent process. Minimum letter height shall be 3/8 inch (10 mm).
- B. Self-Adhesive, Engraved, Laminated Acrylic or Melamine Label: Adhesive backed, with white letters on a dark-gray background. Minimum letter height shall be 3/8 inch (10 mm).
- C. Engraved, Laminated Acrylic or Melamine Label: Punched or drilled for screw mounting. White letters on a dark-gray background. Minimum letter height shall be 3/8 inch (10 mm).

2.8 MISCELLANEOUS IDENTIFICATION PRODUCTS

- A. Paint: Comply with requirements in painting Sections for paint materials and application requirements. Select paint system applicable for surface material and location (exterior or interior).
- B. Fasteners for Labels and Signs: Self-tapping, stainless-steel screws or stainless-steel machine screws with nuts and flat and lock washers.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Verify identity of each item before installing identification products.
- B. Location: Install identification materials and devices at locations for most convenient viewing without interference with operation and maintenance of equipment.
- C. Apply identification devices to surfaces that require finish after completing finish work.
- D. Self-Adhesive Identification Products: Clean surfaces before application, using materials and methods recommended by manufacturer of identification device.
- E. Underground-Line Warning Tape: During backfilling of trenches install continuous underground-line warning tape directly above line at 6 to 8 inches (150 to 200 mm) below finished grade. Use multiple tapes where width of multiple lines installed in a common trench exceeds 16 inches (400 mm) overall.

3.2 IDENTIFICATION SCHEDULE

- A. Accessible Raceways and Metal-Clad Cables, 600 V or Less, for Service, Feeder, and Branch Circuits More Than 30 A, and 120 V to ground: Identify with self-adhesive vinyl label. Install labels at 30-foot (10-m) maximum intervals.
- B. Power-Circuit Conductor Identification, 600 V or Less: For conductors in vaults, pull and junction boxes, manholes, and handholes, use color-coding conductor tape to identify the phase.
  - 1. Color-Coding for Phase Identification, 600 V or Less: Use colors listed below for ungrounded feeder and service conductors.
    - a. Color shall be factory applied or field applied for sizes larger than No. 8 AWG, if authorities having jurisdiction permit.
    - b. Colors for 208/120-V Circuits:
      - 1) Phase A: Black.
      - 2) Phase B: Red.

- 3) Phase C: Blue.
- c. Colors for 480/277-V Circuits:
- 1) Phase A: Brown.
  - 2) Phase B: Orange.
  - 3) Phase C: Yellow.
- C. Install instructional sign including the color-code for grounded and ungrounded conductors using adhesive-film-type labels.
- D. Control-Circuit Conductor Identification: For conductors and cables in pull and junction boxes, and handholes, use self-adhesive vinyl labels with the conductor or cable designation, origin, and destination.
- E. Control-Circuit Conductor Termination Identification: For identification at terminations provide self-adhesive vinyl labels with the conductor designation.
- F. Auxiliary Electrical Systems Conductor Identification: Identify field-installed alarm, control, and signal connections.
1. Identify conductors, cables, and terminals in enclosures and at junctions, terminals, and pull points. Identify by system and circuit designation.
  2. Use system of marker tape designations that is uniform and consistent with system used by manufacturer for factory-installed connections.
  3. Coordinate identification with Project Drawings, manufacturer's wiring diagrams, and the Operation and Maintenance Manual.
- G. Locations of Underground Lines: Identify with underground-line warning tape for power, lighting, communication, and control wiring.
1. Install underground-line warning tape for both direct-buried cables and cables in raceway.
- H. Warning Labels for Indoor Cabinets, Boxes, and Enclosures for Power and Lighting: Self-adhesive warning labels.
1. Comply with 29 CFR 1910.145.
  2. Identify system voltage with black letters on an orange background.
  3. Apply to exterior of door, cover, or other access.
  4. For equipment with multiple power or control sources, apply to door or cover of equipment including, but not limited to, the following:
    - a. Power transfer switches.
    - b. Controls with external control power connections.
- I. Operating Instruction Signs: Install instruction signs to facilitate proper operation and maintenance of electrical systems and items to which they connect. Install instruction signs with approved legend where instructions are needed for system or equipment operation.

- J. Equipment Identification Labels: On each unit of equipment, install unique designation label that is consistent with wiring diagrams, schedules, and the Operation and Maintenance Manual. Apply labels to disconnect switches and protection equipment, central or master units, control panels, control stations, terminal cabinets, and racks of each system. Systems include power, lighting, control, communication, signal, monitoring, and alarm systems unless equipment is provided with its own identification.
1. Labeling Instructions:
    - a. Indoor Equipment: Self-adhesive, engraved, laminated acrylic or melamine label. Unless otherwise indicated, provide a single line of text with 1/2-inch- (13-mm-) high letters on 1-1/2-inch- (38-mm-) high label; where two lines of text are required, use labels 2 inches (50 mm) high.
    - b. Outdoor Equipment: Engraved, laminated acrylic or melamine label.
    - c. Elevated Components: Increase sizes of labels and letters to those appropriate for viewing from the floor.
    - d. Unless provided with self-adhesive means of attachment, fasten labels with appropriate mechanical fasteners that do not change the NEMA or NRTL rating of the enclosure.
  2. Equipment to Be Labeled:
    - a. Panelboards: Typewritten directory of circuits in the location provided by panelboard manufacturer. Panelboard identification shall be self-adhesive, engraved, laminated acrylic or melamine label.
    - b. Enclosures and electrical cabinets.
    - c. Access doors and panels for concealed electrical items.
    - d. Enclosed switches.
    - e. Enclosed circuit breakers.
    - f. Enclosed controllers.
    - g. Variable-speed controllers.
    - h. Push-button stations.
    - i. Contactors.
    - j. Remote-controlled switches, dimmer modules, and control devices.

END OF SECTION 260553

SECTION 260924  
LIGHTING CONTROL DEVICES

PART 1 – GENERAL

1.1 SUMMARY

A. Section Includes:

1. Wall box mounted, wall/corner mounted, and ceiling mounted occupancy sensors including dual technology, ultrasonic, and passive infrared technologies. This includes self contained PIR sensors as well as low voltage sensors that work with Switchpacks.

B. Related Sections:

1. Section 265100 – Interior Lighting.

1.2 REFERENCES

A. American National Standards Institute/Institute of Electrical and Electronic Engineers (ANSI/IEEE)

1. C62.41-1991 – Recommended Practice for Surge Voltages in Low Voltage AC Power Circuits.

B. ASTM International (ASTM)

1. D4674 -02a Standard Test Method for Accelerated Testing for Color Stability of Plastics Exposed to Indoor Fluorescent Lighting and Window-Filtered Daylight.

C. National Electrical Manufacturers Association (NEMA)

1. WD1 (R2005) - General Color Requirements for Wiring Devices.

D. Underwriters Laboratories, Inc. (UL):

1. 94 – Flammability Rating
2. 916 – Energy Management Equipment.
3. 508 (2005) - Standard for Industrial Control Equipment.
4. 244A – Appliance Controls

1.3 SYSTEM DESCRIPTION

A. Permanently installed

1. Wall switch occupancy sensors
2. Ceiling mounted occupancy sensors

1.4 SUBMITTALS

A. Submit under provisions of Section 013300.

B. Specification Conformance Document: Indicate whether the submitted equipment:

1. Meets specification exactly as stated.
2. Meets specification via an alternate means and indicate the specific methodology used.

C. Shop Drawings; include:

1. Load schedule indicating actual connected load, load type, and voltage per circuit, circuits and their respective control zones, circuits that are on emergency, and capacity, phase, and corresponding circuit numbers.
2. Schematic of system.

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3. Lighting plan clearly marking product type, location and orientation of each sensor.
- D. Product Data: Catalog specification sheets with performance specifications demonstrating compliance with specified requirements.

### 1.5 QUALITY ASSURANCE

- A. Manufacturer: Minimum 20 years' experience in manufacture of occupancy sensor lighting controls.
- B. Manufacturer's Quality System: Registered to ISO 9001:2000 Quality Standards, including in-house engineering for product design activities.
- C. Occupancy Sensing Lighting Controls:
  1. Listed by UL specifically for the required loads. Provide evidence of compliance upon request.
- D. Installer Qualifications: Installer shall be one who is experienced in performing the work of this section, and who has specialized in installation of work similar to that required for this project.
- E. Source Limitations: To assure compatibility, obtain occupancy sensors from a single source with complete responsibility over all lighting controls, including accessory products. The use of subcontracted component assemblers is not acceptable.

### 1.6 PROJECT CONDITIONS

- A. Do not install equipment until following conditions can be maintained in spaces to receive equipment:
  1. Ambient temperature: 0° to 40° C (32° to 104° F).
  2. Relative humidity: Maximum 90 percent, non-condensing.
  3. Occupancy Sensors must be protected from dust during installation.

### 1.7 WARRANTY

- A. Provide manufacturer's 5-year parts warranty.

### 1.8 MAINTENANCE

- A. Make ordering of new equipment for expansions, replacements, and spare parts available to end user.
- B. Make new replacement parts available for minimum of ten years from date of manufacture.
- C. Provide factory direct technical support.

## PART 2- PRODUCTS

### 2.1 MANUFACTURERS

- A. Acceptable Manufacturer: Eaton Lighting Systems (formerly Cooper Controls)
- B. Substitutions: Allowed under provisions of Division 1.

### 2.2 SENSOR PERFORMANCE REQUIREMENTS

- A. Sensing mechanism:
  1. Infrared: Utilize multiple segmented lens, with internal grooves to eliminate dust and residue

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build-up.

2. Dual technology:
  - a. Utilize multiple segmented lens, with internal grooves to eliminate dust and residue build-up.
  - b. Utilize an operating frequency of 32 kHz or 40 kHz that shall be crystal controlled to operate within plus or minus 0.005% tolerance.
  - c. Incorporate Doppler shift ultrasonic and passive infrared motion detection technologies. Products that react to noise or ambient sound shall not be considered.
- B. Power failure memory:
  1. Controls incorporate non-volatile memory. Should power be interrupted and subsequently restored, settings and parameters saved in protected memory shall not be lost.
- C. Designed and tested to withstand discharges without impairment of performance when subjected to discharges of 15,000 volts per IEC 801-2.
- D. Products tested in identical manner, complaint to NEMA WD 7 -2011 Occupancy Motion Sensors Standards.
- E. Sensor shall have time delays from 10 to 30 min.
- F. When specified, sensors shall automatically adjust time delay and sensitivity settings.
- G. 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.
- H. All sensors shall have readily accessible, user adjustable settings for time delay and sensitivity. Settings shall be located on the sensor (not the control unit) and shall be recessed to limit tampering.
- I. 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.

### 2.3 LINE VOLTAGE CEILING MOUNTED OCCUPANCY SENSORS

- A. Product: OAC-DT-2000-MV, OAC-DT-2000-DMV
- B. Provide all necessary mounting hardware and instructions.
- C. Capable of detection of occupancy at desktop level up to 300 square feet, and gross motion up to 1000 square feet
- D. Shall accommodate loads from 0-800 watts at 120 volts; 0 to 1200 watts at 277 volts and shall have 180 degree coverage capability.
- E. Shall be able to have their visible plastic parts replaced, for color changes in the field, without removing the body of the control from the wall and without requiring special tools.
- F. Shall utilize Zero Crossing Circuitry which increases relay life, protects from the effects of inrush current, and increases sensor's longevity.
- G. Shall have no leakage current to load, in manual or in Auto/Off Mode for safety purposes and shall have voltage drop protection.
- H. Where specified, dual relay sensors shall offer daylighting foot-candle adjustment control for either or both relays.



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### 2.4 OCCUPANCY WALL SWITCHES

- A. Product: OSW-P-0451-MV-\*, ONW-P-1001-MV-\*, ONW-P-1001-347-\*, ONW-P-1001-DMV-\*, ONW-P-1001-D347-\*, ONW-P-1001-SP-\*, ONW-P-1001-RR7-\*
- B. Capable of detection of occupancy at desktop level up to 300 square feet, and gross motion up to 1000 square feet
- C. Shall accommodate loads from 0-800 watts at 120 volts; 0 to 1200 watts at 277 volts and shall have 180 degree coverage capability.
- D. Shall be able to have their visible plastic parts replaced, for color changes in the field, without removing the body of the control from the wall and without requiring special tools.
- E. Shall utilize Zero Crossing Circuitry which increases relay life, protects from the effects of inrush current, and increases sensor's longevity.
- F. Shall have no leakage current to load, in manual or in Auto/Off Mode for safety purposes and shall have voltage drop protection.
- G. Where specified, wall switch sensors shall provide a field selectable option to convert sensor operation from Automatic On to Manual On.
- H. Where specified, dual relay sensors shall offer daylighting footcandle adjustment control for either or both relays.

### 2.5 SOURCE QUALITY CONTROL

- A. Perform full-function testing on 100% of all system components and panel assemblies at the factory.

## PART 3- EXECUTION

### 3.1 INSTALLATION

- A. Install equipment in accordance with manufacturer's installation instructions.
- B. Provide complete installation of system in accordance with Contract Documents.
- C. Provide equipment at locations and in quantities indicated on Drawings. Provide any additional equipment required to provide control intent.

### 3.2 TESTING

- A. Upon completion of all wiring and after all fixtures are installed and lamped, a representative shall check the installation prior to energizing the system. Each installed occupancy sensor shall be tested in the Test Mode to see that lights turn OFF and on based on occupancy.
- B. At the time testing, the owner's representative shall be thoroughly instructed in the proper operation of the system.

END OF SECTION

SECTION 261900  
SUPPORTING DEVICES

PART 1 GENERAL

1.01 WORK INCLUDED

- A. Conduit and equipment supports.
- B. Fastening hardware.

1.02 RELATED WORK

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

PART 2 PRODUCTS

2.01 MATERIAL

- A. Support Channel: Galvanized or painted steel.
- B. Hardware: Corrosion resistant.

PART 3 EXECUTION

3.01 INSTALLATION

- A. Install products in accordance with manufacturer's instructions.
- B. Fasten hanger rods, conduit clamps, and outlet and junction boxes to building structure using pre-cast insert system, expansion anchors, beam clamps.
- C. Anchors and Fasteners
  - 1) Concrete Structural Elements: Use pre-cast insert system, expansion anchors, powder actuated anchors and preset inserts.
  - 2) Steel Structural Elements: Use beam clamps, steel ramset fasteners, and welded fasteners.
  - 3) Concrete Surfaces: Use self-drilling anchors and expansion anchors.
  - 4) Hollow Masonry, Plaster, and Gypsum Board Partitions: Use toggle bolts and hollow wall fasteners.
  - 5) Solid Masonry Walls: Use expansion anchors and preset inserts.
  - 6) Sheet Metal: Use sheet metal screws.
  - 7) Wood Elements: Use wood screws.

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- D. Do not fasten supports to piping, ductwork, mechanical equipment, or conduit.
- E. Do not use power-actuated anchors.
- F. Do not drill structural steel members.
- G. Fabricate supports or trapeze hangers from structural steel or steel channel, rigidly welded or bolted to present a neat appearance. Use hexagon head bolts with spring lock washers under all nuts.
- H. In wet locations install free-standing electrical equipment on concrete pads.
- I. Install surface-mounted cabinets and panelboards with minimum of four anchors. Provide steel channel supports to stand cabinet one inch off wall.

\*\*\* END OF SECTION \*\*\*

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### SECTION 262200 - LOW-VOLTAGE TRANSFORMERS

#### PART 1 - GENERAL

##### 1.1 SUMMARY

- A. This Section includes the following types of dry-type transformers rated 600 V and less, with capacities up to 1000 kVA:
  - 1. Distribution transformers.

##### 1.2 ACTION SUBMITTALS

- A. Product Data: For each product indicated.
- B. Shop Drawings: Indicate dimensions and weights.
  - 1. Wiring Diagrams: Power, signal, and control wiring.

##### 1.3 INFORMATIONAL SUBMITTALS

- A. Field quality-control test reports.

##### 1.4 CLOSEOUT SUBMITTALS

- A. Operation and maintenance data.

##### 1.5 QUALITY ASSURANCE

- A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.
- B. Comply with IEEE C57.12.91, "Test Code for Dry-Type Distribution and Power Transformers."

#### PART 2 - PRODUCTS

##### 2.1 GENERAL TRANSFORMER REQUIREMENTS

- A. Description: Factory-assembled and -tested, air-cooled units for 60-Hz service.
- B. Cores: Grain-oriented, non-aging silicon steel.

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- C. Coils: Continuous windings without splices except for taps.
  - 1. Internal Coil Connections: Brazed or pressure type.
  - 2. Coil Material: Copper.

### 2.2 DISTRIBUTION TRANSFORMERS

- A. Comply with NEMA ST 20, and list and label as complying with UL 1561.
- B. Cores: One leg per phase.
- C. Enclosure: Ventilated, NEMA 250, Type 2.
  - 1. Core and coil shall be encapsulated within resin compound, sealing out moisture and air.
- D. Transformer Enclosure Finish: Comply with NEMA 250.
  - 1. Finish Color: Gray.
- E. Taps for Transformers 25 kVA and Larger: Two 2.5 percent taps above and two 2.5 percent taps below normal full capacity.
- F. Insulation Class: 220 deg C, UL-component-recognized insulation system with a maximum of 150 deg C rise above 40 deg C ambient temperature.
- G. Energy Efficiency for Transformers Rated 15 kVA and Larger:
  - 1. Complying with NEMA TP 1, Class 1 efficiency levels.
  - 2. Tested according to NEMA TP 2.
- H. Wall Brackets: Manufacturer's standard brackets.

### 2.3 IDENTIFICATION DEVICES

- A. Nameplates: Engraved, laminated-plastic or metal nameplate. Nameplates are specified in Section 260553 "Identification for Electrical Systems."

## PART 3 - EXECUTION

### 3.1 INSTALLATION

- A. Install wall-mounting transformers level and plumb with wall brackets fabricated by transformer manufacturer.
  - 1. Brace wall-mounting transformers as specified in Section 260548 "Vibration and Seismic Controls for Electrical Systems."

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### 3.2 FIELD QUALITY CONTROL

- A. Perform tests and inspections.
- B. Tests and Inspections:
  - 1. Perform each visual and mechanical inspection and electrical test stated in NETA Acceptance Testing Specification. Certify compliance with test parameters.
  - 2. Infrared Scanning: Two months after Substantial Completion, perform an infrared scan of transformer connections.
    - a. Use an infrared-scanning device designed to measure temperature or detect significant deviations from normal values. Provide documentation of device calibration.
    - b. Perform 2 follow-up infrared scans of transformers, one at 4 months and the other at 11 months after Substantial Completion.
    - c. Prepare a certified report identifying transformer checked and describing results of scanning. Include notation of deficiencies detected, remedial action taken, and scanning observations after remedial action.

### 3.3 ADJUSTING

- A. Adjust transformer taps to provide optimum voltage conditions at secondary terminals. Optimum is defined as not exceeding nameplate voltage plus 10 percent and not being lower than nameplate voltage minus 3 percent at maximum load conditions. Submit recording and tap settings as test results.
- B. Connect buck-boost transformers to provide nameplate voltage of equipment being served, plus or minus 5 percent, at secondary terminals.
- C. Output Settings Report: Prepare a written report recording output voltages and tap settings.

END OF SECTION 262200

SECTION 262713 - ELECTRICITY METERING

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 equipment for electricity metering by utility company.

1.3 ACTION SUBMITTALS

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

1.4 QUALITY ASSURANCE

- A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Receive, store, and handle modular meter center according to NECA 400.

1.6 COORDINATION

- A. Electrical Service Connections: Coordinate with utility companies and components they furnish as follows:
  1. Comply with requirements of utilities providing electrical power services.
  2. Coordinate installation and connection of utilities and services, including provision for electricity-metering components.

PART 2 - PRODUCTS

2.1 EQUIPMENT FOR ELECTRICITY METERING BY UTILITY COMPANY

- A. Meters will be furnished by utility company.

- B. Modular Meter Center: Factory-coordinated assembly of a main service disconnect device, wireways, tenant meter socket modules, and tenant feeder circuit breakers arranged in adjacent vertical sections. Assembly shall be complete with interconnecting buses and other features as specified below.
  - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. Eaton Electrical Inc.; Cutler-Hammer Business Unit.
    - b. General Electric Company; GE Consumer & Industrial - Electrical Distribution.
    - c. Siemens Energy & Automation, Inc.
    - d. Square D; a brand of Schneider Electric.
  - 2. Comply with requirements of utility company for meter center.
  - 3. Housing: NEMA 250, Type 3R enclosure.
  - 4. Minimum Short-Circuit Rating: 42,000 A symmetrical at rated voltage.
  - 5. Main Disconnect Device: Circuit breaker, series-combination rated for use with downstream feeder and branch circuit breakers.
  - 6. Tenant Feeder Circuit Breakers: Series-combination-rated molded-case units, rated to protect circuit breakers in downstream tenant and house load centers that have 10,000A interrupting capacity.
    - a. Identification: Complying with requirements in Section 260553 "Identification for Electrical Systems" with legend identifying tenant's address.
    - b. Physical Protection: Tamper resistant, with hasp for padlock.
  - 7. Meter Socket: Rating coordinated with indicated tenant feeder circuit rating.

### PART 3 - EXECUTION

#### 3.1 INSTALLATION

- A. Comply with equipment installation requirements in NECA 1.
- B. Install meters furnished by utility company. Install raceways and equipment according to utility company's written requirements. Provide empty conduits for metering leads and extend grounding connections as required by utility company.

#### 3.2 IDENTIFICATION

- A. Comply with requirements for identification specified in Section 260553 "Identification for Electrical Systems."
  - 1. Series Combination Warning Label: Self-adhesive type, with text as required by NFPA 70.
  - 2. Equipment Identification Labels: Adhesive film labels with clear protective overlay.



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END OF SECTION 262713

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### SECTION 262726 - WIRING DEVICES

#### PART 1 - GENERAL

##### 1.1 RELATED DOCUMENTS

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

##### 1.2 SUMMARY

- A. Section Includes:
  - 1. Receptacles, receptacles with integral GFCI, and associated device plates.
  - 2. Weather-resistant receptacles.
  - 3. Snap switches and wall-box dimmers.
  - 4. Cord and plug sets.

##### 1.3 ADMINISTRATIVE REQUIREMENTS

- A. Coordination:
  - 1. Receptacles for Owner-Furnished Equipment: Match plug configurations.
  - 2. Cord and Plug Sets: Match equipment requirements.

##### 1.4 ACTION SUBMITTALS

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

#### PART 2 - PRODUCTS

##### 2.1 MANUFACTURERS

- A. Manufacturers' Names: Shortened versions (shown in parentheses) of the following manufacturers' names are used in other Part 2 articles:
  - 1. Cooper Wiring Devices; Division of Cooper Industries, Inc. (Cooper).
  - 2. Hubbell Incorporated; Wiring Device-Kellems (Hubbell).
  - 3. Leviton Mfg. Company Inc. (Leviton).
  - 4. Pass & Seymour/Legrand (Pass & Seymour).

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- B. Source Limitations: Obtain each type of wiring device and associated wall plate from single source from single manufacturer.

### 2.2 GENERAL WIRING-DEVICE REQUIREMENTS

- A. Wiring Devices, Components, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- B. Comply with NFPA 70.
- C. Devices that are manufactured for use with modular plug-in connectors may be substituted under the following conditions:
  - 1. Connectors shall comply with UL 2459 and shall be made with stranding building wire.
  - 2. Devices shall comply with the requirements in this Section.

### 2.3 STRAIGHT-BLADE RECEPTACLES

- A. Convenience Receptacles, 125 V, 20 A: Comply with NEMA WD 1, NEMA WD 6 Configuration 5-20R, UL 498, and FS W-C-596.
  - 1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:

### 2.4 GFCI RECEPTACLES

- A. General Description:
  - 1. Straight blade, non-feed-through type.
  - 2. Comply with NEMA WD 1, NEMA WD 6, UL 498, UL 943 Class A, and FS W-C-596.
  - 3. Include indicator light that shows when the GFCI has malfunctioned and no longer provides proper GFCI protection.
- B. Duplex GFCI Convenience Receptacles, 125 V, 20 A:
  - 1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:

### 2.5 CORD AND PLUG SETS

- A. Description:
  - 1. Match voltage and current ratings and number of conductors to requirements of equipment being connected.

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2. Cord: Rubber-insulated, stranded-copper conductors, with Type SOW-A jacket; with green-insulated grounding conductor and ampacity of at least 130 percent of the equipment rating.
3. Plug: Nylon body and integral cable-clamping jaws. Match cord and receptacle type for connection.

### 2.6 TOGGLE SWITCHES

- A. Comply with NEMA WD 1, UL 20, and FS W-S-896.
- B. Switches, 120/277 V, 20 A:
  1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:

### 2.7 WALL-BOX DIMMERS

- A. Control: Continuously adjustable slider; with single-pole or three-way switching. Comply with UL 1472.

### 2.8 WALL PLATES

- A. Single and combination types shall match corresponding wiring devices.
  1. Plate-Securing Screws: Metal with head color to match plate finish.
  2. Material for Finished Spaces: Smooth, high-impact thermoplastic.
  3. Material for Unfinished Spaces: Galvanized steel.
  4. Material for Damp Locations: Cast aluminum with spring-loaded lift cover, and listed and labeled for use in wet and damp locations.
- B. Wet-Location, Weatherproof Cover Plates: NEMA 250, complying with Type 3R, weather-resistant, die-cast aluminum with lockable cover.

### 2.9 FLOOR SERVICE FITTINGS

- A. Type: Modular, flush-type, dual-service units suitable for wiring method used.
- B. Compartments: Barrier separates power from voice and data communication cabling.
- C. Service Plate: Round, die-cast aluminum with satin finish.
- D. Power Receptacle: NEMA WD 6 Configuration 5-20R, gray finish, unless otherwise indicated.
- E. Voice and Data Communication Outlet: Two modular, keyed, color-coded, RJ-45 jacks for UTP cable complying with requirements in Section 271500 "Communications Horizontal Cabling."

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### 2.10 FINISHES

#### A. Device Color:

1. Wiring Devices Connected to Normal Power System: As selected by Architect unless otherwise indicated or required by NFPA 70 or device listing.

## PART 3 - EXECUTION

### 3.1 INSTALLATION

#### A. Comply with NECA 1, including mounting heights listed in that standard, unless otherwise indicated.

#### B. Coordination with Other Trades:

1. Protect installed devices and their boxes. Do not place wall finish materials over device boxes and do not cut holes for boxes with routers that are guided by riding against outside of boxes.
2. Keep outlet boxes free of plaster, drywall joint compound, mortar, cement, concrete, dust, paint, and other material that may contaminate the raceway system, conductors, and cables.
3. Install device boxes in brick or block walls so that the cover plate does not cross a joint unless the joint is troweled flush with the face of the wall.
4. Install wiring devices after all wall preparation, including painting, is complete.

#### C. Conductors:

1. Do not strip insulation from conductors until right before they are spliced or terminated on devices.
2. Strip insulation evenly around the conductor using tools designed for the purpose. Avoid scoring or nicking of solid wire or cutting strands from stranded wire.
3. The length of free conductors at outlets for devices shall meet provisions of NFPA 70, Article 300, without pigtails.

#### D. Device Installation:

1. Replace devices that have been in temporary use during construction and that were installed before building finishing operations were complete.
2. Keep each wiring device in its package or otherwise protected until it is time to connect conductors.
3. Do not remove surface protection, such as plastic film and smudge covers, until the last possible moment.
4. Connect devices to branch circuits using pigtails that are not less than 6 inches (152 mm) in length.

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5. When there is a choice, use side wiring with binding-head screw terminals. Wrap solid conductor tightly clockwise, two-thirds to three-fourths of the way around terminal screw.
6. Use a torque screwdriver when a torque is recommended or required by manufacturer.
7. When conductors larger than No. 12 AWG are installed on 15- or 20-A circuits, splice No. 12 AWG pigtails for device connections.
8. Tighten unused terminal screws on the device.
9. When mounting into metal boxes, remove the fiber or plastic washers used to hold device-mounting screws in yokes, allowing metal-to-metal contact.

### E. Receptacle Orientation:

1. Install ground pin of vertically mounted receptacles down, and on horizontally mounted receptacles to the right.

### F. Device Plates: Do not use oversized or extra-deep plates. Repair wall finishes and remount outlet boxes when standard device plates do not fit flush or do not cover rough wall opening.

### G. Dimmers:

1. Install dimmers within terms of their listing.
2. Install unshared neutral conductors on line and load side of dimmers according to manufacturers' device listing conditions in the written instructions.

### H. Arrangement of Devices: Unless otherwise indicated, mount flush, with long dimension vertical and with grounding terminal of receptacles on top. Group adjacent switches under single, multigang wall plates.

### I. Adjust locations of floor service outlets and service poles to suit arrangement of partitions and furnishings.

## 3.2 GFCI RECEPTACLES

- A. Install non-feed-through-type GFCI receptacles where protection of downstream receptacles is not required.

## 3.3 IDENTIFICATION

- A. Comply with Section 260553 "Identification for Electrical Systems."
- B. Identify each receptacle with panelboard identification and circuit number. Use hot, stamped, or engraved machine printing with black-filled lettering on face of plate, and durable wire markers or tags inside outlet boxes.

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3.4 FIELD QUALITY CONTROL

- A. Test straight-blade for the retention force of the grounding blade according to NFPA 99. Retention force shall be not less than 4 oz. (115 g).
- B. Wiring device will be considered defective if it does not pass tests and inspections.
- C. Prepare test and inspection reports.

END OF SECTION 262726

SECTION 263213

ENGINE GENERATORS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. This Section includes packaged engine-generator sets suitable for use in applications with the features as specified and indicated where the engine generators will be used as the standby power source for the system.

1.3 DEFINITIONS

- A. Operational Bandwidth: The total variation from the lowest to highest value of a parameter over the range of conditions indicated, expressed as a percentage of the nominal value of the parameter.
- B. Emergency Standby Power (ESP): Per ISO 8528: The maximum power available during a variable electrical power sequence, under the stated operating conditions, for which a generating set is capable of delivering in the event of a utility power outage or under test conditions for up to 200 h of operation per year with the maintenance intervals and procedures being carried out as prescribed by the manufacturers. The permissible average power output (Ppp) over 24 h of operation shall not exceed 70 % of the ESP unless otherwise agreed by the RIC engine manufacturer.

1.4 ACTION SUBMITTALS

- A. Product Data: For each type of packaged engine generator indicated. Include rated capacities, operating characteristics, and furnished specialties and accessories. In addition, include the following:
  - 1. Thermal damage curve for generator.
  - 2. Time-current characteristic curves for generator protective device.
  - 3. Sound test data, based on a free field requirement.
- B. Shop Drawings: Detail equipment assemblies and indicate dimensions, weights, and location and size of each field connection.



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1. Dimensioned outline plan and elevation drawings of engine-generator set and other components specified.
2. Wiring Diagrams: Control interconnection, Customer connections.

C. Certifications:

1. Submit statement of compliance which states the proposed product(s) is certified to the emissions standards required by the location and application of the Project.

### 1.5 INFORMATIONAL SUBMITTALS

A. Warranty:

1. Submit manufacturer's warranty statement to be provided for this Project.

### 1.6 QUALITY ASSURANCE

- A. Installer Qualifications: Manufacturer's authorized representative who is trained and approved for installation of units required for this Project.
- B. Manufacturer Qualifications: A qualified manufacturer. Maintain, within 200 miles of Project site, a service center capable of providing training, parts, and emergency maintenance repairs.
- C. Source Limitations: Obtain packaged generator sets and auxiliary components through one source from a single manufacturer.
- D. Comply with NFPA 70 (National Electrical Code. Equipment shall be suitable for use in systems in compliance to Article 700, 701, and 702).
- E. Comply with NFPA 110 (Emergency and Standby Power Systems) requirements for Level 1 emergency power supply system.
- F. Comply with UL 2200.
- G. Noise Emission: Comply with applicable state and local government requirements for maximum noise level at adjacent property boundaries due to sound emitted by generator set including engine, engine exhaust, engine cooling-air intake and discharge, and other components of installation.

### 1.7 PROJECT CONDITIONS

- A. Environmental Conditions: Engine-generator system shall withstand the following environmental conditions without mechanical or electrical damage or degradation of performance capability:
  1. Ambient Temperature: Minus 15 to plus 40 deg C.
  2. Relative Humidity: 0 to 95 percent.
  3. Altitude: Sea level to 1000 feet (300 m).

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### 1.8 WARRANTY

- A. Base Warranty: Manufacturer shall provide base warranty coverage on the material and workmanship of the generator set for a minimum of twenty-four (24) months for Standby product and twelve (12) months for Prime/Continuous product from registered commissioning and start-up.

## PART 2 - PRODUCTS

### 2.1 MANUFACTURERS

- A. Manufacturers: Only approved bidders shall supply equipment provided under this contract. Equipment by other named suppliers that meets the requirement of this specification are acceptable if approved not less than 2 weeks before scheduled bid date.

- 1. Cummins Power Generation
- 2. Caterpillar
- 3. Kohler
- 4. Generac

### 2.2 ENGINE-GENERATOR SET

- A. Factory-assembled and -tested, engine-generator set.
- B. Mounting Frame: Maintain alignment of mounted components without depending on concrete foundation; and have lifting attachments.
  - 1. Rigging Information: Indicate location of each lifting attachment, generator-set center of gravity, and total package weight in submittal drawings.
- C. Capacities and Characteristics:
  - 1. Power Output Ratings: Continuous electrical output power rating for standby operation of not less than as shown on drawings, at 80 percent lagging power factor, 480/277-volt, three phase, 4-wire, 60 hertz.
  - 2. Alternator shall be capable of accepting maximum load in a single step and be capable of recovering to a minimum of 90% of rated no load voltage. Following the application of the specified kVA load at near zero power factor applied to the generator set.
  - 3. Nameplates: For each major system component to identify manufacturer's name and address, and model and serial number of component. The engine-generator nameplate shall include information of the power output rating of the equipment.
- D. Generator-Set Performance:

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1. Steady-State Voltage Operational Bandwidth: 0.5 percent of rated output voltage from no load to full load.
2. Transient Voltage Performance: Not more than 20 percent variation for 50 percent step-load increase or decrease. Voltage shall recover and remain within the steady-state operating band within three seconds. On application of a 100% load step the generator set shall recover to stable voltage within 10 seconds.
3. Steady-State Frequency Operational Bandwidth: 0.25 percent of rated frequency from no load to full load.
4. Steady-State Frequency Stability: When system is operating at any constant load within the rated load, there shall be no random speed variations outside the steady-state operational band and no hunting or surging of speed.
5. Transient Frequency Performance: Less than 5 percent variation for 50 percent step-load increase or decrease. Frequency shall recover and remain within the steady-state operating band within five seconds. On application of a 100% load step the generator set shall recover to stable frequency within 10 seconds.
6. Output Waveform: At full load, harmonic content measured line to line or line to neutral shall not exceed 5 percent total and 3 percent for any single harmonic. Telephone influence factor, determined according to NEMA MG 1, shall not exceed 50.
8. Start Time: Comply with NFPA 110, Level 1, Type 10, system requirements. Ambient Condition Performance: Engine generator shall be designed to allow operation at full rated load in an ambient temperature under site conditions, based on highest ambient condition. Ambient temperature shall be as measured at the air inlet to the engine generator for enclosed units, and at the control of the engine generator for machines installed in equipment rooms.
9. Noise Output: Engine generator shall be tested by the manufacturer per ANSI S12.34. Data documenting performance shall be provided with submittal documentation.

### 2.3 ENGINE

- A. Fuel: Natural Gas.
- B. Rated Engine Speed: 1800 rpm.
- C. Lubrication System: The following items are mounted on engine or skid:
  1. Lube oil pump: shall be positive displacement, mechanical, full pressure pump.
  2. Filter and Strainer: Provided by the engine manufacturer of record to provide adequate filtration for the prime mover to be used.
  3. Crankcase Drain: Arranged for complete gravity drainage to an easily removable container with no disassembly and without use of pumps, siphons, special tools, or appliances.
- D. Engine Fuel System: The engine fuel system shall be installed in strict compliance to the engine manufacturer's instructions.
- E. Coolant Jacket Heater: Electric-immersion type, factory installed in coolant jacket system. Comply with NFPA 110 requirements for Level 1 equipment for heater capacity and performance.

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1. Designed for operation on a single 120-volt AC, single phase, 60 hertz power connection. Heater voltage shall be shown on the project drawings.
  2. Provided with a 12VDC thermostat, installed at the engine thermostat housing
- F. Governor: Adjustable isochronous, with speed sensing.
- G. Cooling System: Closed loop, liquid cooled, with radiator factory mounted on engine-generator-set mounting frame.
1. The generator set manufacturer shall provide prototype test data for the specific hardware proposed demonstrating that the machine will operate at rated standby load in an outdoor ambient condition of 40C.
  2. Coolant: Solution of 50 percent ethylene-glycol-based antifreeze and 50 percent water, with anticorrosion additives as recommended by engine manufacturer.
  3. Size of Radiator overflow tank: Adequate to contain expansion of total system coolant from cold start to 110 percent load condition.
  4. Expansion Tank: Constructed of welded steel plate and rated to withstand maximum closed-loop coolant system pressure for engine used. Equip with gage glass and petcock.
  5. Temperature Control: Self-contained, thermostatic-control valve modulates coolant flow automatically to maintain optimum constant coolant temperature as recommended by engine manufacturer.
  6. Duct Flange: Generator sets installed indoors shall be provided with a flexible radiator duct adapter flange.
- H. Muffler/Silencer: Selected with performance as required to meet sound requirements of the application, sized as recommended by engine manufacturer and selected with exhaust piping system to not exceed engine manufacturer's engine backpressure requirements. For generator sets with outdoor enclosures the silencer shall be inside the enclosure.
- I. Air-Intake Filter: Engine-mounted air cleaner with replaceable dry-filter element and restriction indicator.
- J. Starting System: 12VDC, as recommended by the engine manufacturer; electric, with negative ground.
1. Components: Sized so they will not be damaged during a full engine-cranking cycle with ambient temperature at maximum specified in Part 1 "Project Conditions" Article.
  2. Cranking Cycle: As required by NFPA 110 for level 1 systems.
  3. Battery Cable: Size as recommended by engine manufacturer for cable length as required. Include required interconnecting conductors and connection accessories.
  4. Battery Compartment: Factory fabricated of metal with acid-resistant finish.
  5. Battery-Charging Alternator: Factory mounted on engine with solid-state voltage regulation. The battery charging alternator shall have sufficient capacity to recharge the batteries with all parasitic loads connected within 4 hours after a normal engine starting sequence.
  6. Battery Chargers: Unit shall comply with UL 1236 and include the following features:

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- a. Operation: Equalizing-charging rate of 10 A shall be initiated automatically after battery has lost charge until an adjustable equalizing voltage is achieved at battery terminals. Unit shall then be automatically switched to a lower float-charging mode and shall continue to operate in that mode until battery is discharged again.
- b. Automatic Temperature Compensation: Adjust float and equalize voltages for variations in ambient temperature from minus 40 deg C to plus 60 deg C to prevent overcharging at high temperatures and undercharging at low temperatures.
- c. Automatic Voltage Regulation: Maintain constant output voltage regardless of input voltage variations up to plus or minus 10 percent.
- d. Ammeter and Voltmeter: Flush mounted in door. Meters shall indicate charging rates.
- e. Safety Functions: Sense abnormally low battery voltage and close contacts providing low battery voltage indication on control and monitoring panel. Sense high battery voltage and loss of ac input or dc output of battery charger. Either condition shall close contacts that provide a battery-charger malfunction indication at system control and monitoring panel.
- f. Enclosure and Mounting: NEMA 250, Type 1, wall-mounted cabinet.

### 2.4 CONTROL AND MONITORING

- A. Engine generator control shall be microprocessor based and provide automatic starting, monitoring, protection and control functions for the unit
- B. Automatic Starting System Sequence of Operation: When mode-selector switch on the control and monitoring panel is in the automatic position, remote-control contacts in one or more separate automatic transfer switches initiate starting and stopping of generator set. When mode-selector switch is switched to the on position, generator set starts. The off position of same switch initiates generator-set shutdown. (Switches with different configurations but equal functions are acceptable.) When generator set is running, specified system or equipment failures or derangements automatically shut down generator set and initiate alarms. Operation of the local (generator set-mounted) and/or remote emergency-stop switch also shuts down generator set.
- C. Manual Starting System Sequence of Operation: Switching on-off switch on the generator control panel to the on position starts generator set. The off position of same switch initiates generator-set shutdown. When generator set is running, specified system or equipment failures or derangements automatically shut down generator set and initiate alarms. Operation of the local (generator set-mounted) and/or remote emergency-stop switch also shuts down generator set.
- D. Configuration: Operating and safety indications, protective devices, system controls, engine gages and associated equipment shall be grouped in a common control and monitoring panel. Mounting method shall isolate the control panel from generator-set vibration. AC output power circuit breakers and other output power equipment shall not be mounted in the control enclosure.

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- E. Indicating and Protective Devices and Controls: As required by NFPA 110 for Level 1 system, and the following:
1. AC voltmeter (3-phase, line to line and line to neutral values).
  2. AC ammeter (3-phases).
  3. AC frequency meter.
  4. AC kVA output (total and for each phase). Display shall indicate power flow direction.
  5. Ammeter-voltmeter displays shall simultaneously display conditions for all three phases.
  6. Emergency Stop Switch: Switch shall be a red “mushroom head” pushbutton device complete with lock-out/tag-out provisions. Depressing switch shall cause the generator set to immediately stop the generator set and prevent it from operating.
  7. Fault Reset Switch: Supply a dedicated control switch to reset/clear fault conditions.
  8. DC voltmeter (alternator battery charging).
  9. Engine-coolant temperature gage.
  10. Engine lubricating-oil pressure gage.
  11. Running-time meter.
  12. Generator-voltage and frequency digital raise/lower switches. Rheostats for these functions are not acceptable. The control shall adjustment of these parameters in a range of plus or minus 5% of the voltage and frequency operating set point (not nominal voltage and frequency values.)
  13. AC Protective Equipment: The control system shall include over/under voltage, over current, short circuit, loss of voltage reference, and over excitation shut down protection. There shall be an overload warning, and overcurrent warning alarm.
  14. Status LED indicating lamps to indicate remote start signal present at the control, existing alarm condition, not in auto, and generator set running.
  15. A graphical display panel with appropriate navigation devices shall be provided to view all information noted above, as well as all engine status and alarm/shutdown conditions (including those from an integrated engine emission control system). The display shall also include integrated provisions for adjustment of the gain and stability settings for the governing and voltage regulation systems.
  16. Panel lighting system to allow viewing and operation of the control when the generator room or enclosure is not lighted.
  17. DC control Power Monitoring: The control system shall continuously monitor DC power supply to the control, and annunciate low or high voltage conditions. It shall also provide an alarm indicating imminent failure of the battery bank based on degraded voltage recover on loading (engine cranking).
- F. Control Heater: Generator sets that are installed in outdoor enclosures, or are in tropical or coastal environments shall be provided with control heaters for anti-condensation protection.
- G. Common Remote Audible Alarm: Comply with NFPA 110 requirements for Level 1 systems. Include necessary contacts and terminals in control and monitoring panel.
1. Overcrank shutdown.
  2. Coolant low-temperature alarm.
  3. Control switch not in auto position.

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4. Battery-charger malfunction alarm.
  5. Battery low-voltage alarm.
- H. Remote Alarm Annunciator: Comply with NFPA 110. An LED labeled with proper alarm conditions shall identify each alarm event and a common audible signal shall sound for each alarm condition.
- I. Remote Emergency-Stop Switch: Flush; wall mounted, unless otherwise indicated; and labeled. Push button shall be protected from accidental operation.

### 2.5 GENERATOR OVERCURRENT AND FAULT PROTECTION

- A. Generator Overcurrent Protection: The generator set shall be provided with a UL Listed/CSA Certified protective device that is coordinated with the alternator provided to prevent damage to the generator set on any possible overload or overcurrent condition external to the machine. The protective device shall be listed as a utility grade protective device under UL category NRGU. The control system shall be subject to UL follow-up service at the manufacturing location to verify that the protective system is fully operational as manufactured. Protector shall perform the following functions:
1. Initiates a generator kW overload alarm when generator has operated at an overload equivalent to 110 percent of full-rated load for 60 seconds. Indication for this alarm is integrated with other generator-set malfunction alarms.
  2. Under single phase or multiple phase fault conditions, or on overload conditions, indicates an alarm conditions when the current flow is in excess of 110% of rated current for more than 10 seconds.
  3. Under single phase or multiple phase fault conditions, operates to switch off alternator excitation at the appropriate time to prevent damage to the alternator.
  4. The operator panel shall indicate the nature of the fault condition as either a short circuit or an overload.
  5. Senses clearing of a fault by other overcurrent devices and controls recovery of rated voltage to avoid overshoot greater than 120% of nominal voltage.
  6. The protective system provided shall not include an instantaneous trip function.
- B. Ground-Fault Indication: Comply with NFPA 70, "Emergency System" signals for ground-fault. Integrate ground-fault alarm indication with other generator-set alarm indications.

### 2.6 GENERATOR, EXCITER, AND VOLTAGE REGULATOR

- A. Comply with NEMA MG 1.
- B. Drive: Generator shaft shall be directly connected to engine shaft. Exciter shall be rotated integrally with generator rotor.
- C. Class H Electrical Insulation shall be used for systems of under 690V.
- D. Temperature Rise: 105C over a 40C environment.

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- E. Construction shall prevent mechanical, electrical, and thermal damage due to vibration, overspeed up to 125 percent of rating, and heat during operation at 110 percent of rated capacity.
- F. Permanent Magnet Generator (PMG) shall provide excitation power for optimum motor starting and short circuit performance on all alternators rated 30kVA and larger.
- G. Voltage Regulator: Separate from exciter, providing performance as specified. The voltage regulation system shall be microprocessor-controlled, full wave rectified, and provide a pulse-width modulated signal to the exciter. No exceptions or deviations to these requirements will be permitted.
- H. The alternator shall be provided with anti-condensation heater(s) in all applications where the generator set is provided in an outdoor enclosure, or when the generator set is installed in a coastal or tropical environment.
- I. Windings: Two-thirds pitch stator winding.
- J. Subtransient Reactance: 15 percent maximum, based on the rating of the engine generator set.

### 2.7 OUTDOOR GENERATOR-SET ENCLOSURE

- A. Description: Weather protective housing. Multiple panels shall be lockable and provide adequate access to components requiring maintenance. Instruments, control, and battery system shall be mounted within enclosure.
- B. Construction:
  - 1. Hinged Doors: With padlocking provisions. Restraint/Hold back hardware to prevent door to keep door open at 180 degrees during maintenance. Rain lips over all doors.
  - 2. Exhaust System:
    - a. Muffler Location: Within enclosure.
  - 3. Hardware: All hardware and hinges shall be stainless steel.
  - 4. A weather protective enclosure shall be provided which allows the generator set to operate at full rated load with a static pressure drop equal to or less than 0.5 inches of water.
- C. Engine Cooling Airflow through Enclosure: Housing shall provide ample airflow for engine generator operation at rated load in an ambient temperature of 40 degrees Celsius.
  - 1. Louvers: Fixed-engine, cooling-air inlet and discharge.
- D. Sound Performance: Reduce the average sound level of the engine generator while operating at full rated load to a maximum of 80 dBA measured at 7 meters from the engine generator in a free field environment.
- E. Site Provisions:



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1. Lifting: Complete assembly of engine generator, and enclosure shall be designed to be lifted into place as a single unit.

### 2.8 FINISHES

- A. Indoor and Outdoor Enclosures and Components: Powder-coated and baked over corrosion-resistant pretreatment and compatible primer. Manufacturer's standard color or as directed on the drawings.

### 2.9 SOURCE QUALITY CONTROL

- A. Prototype Testing: Factory test engine-generator set using same engine model, constructed of identical or equivalent components and equipped with identical or equivalent accessories.
  1. Tests: Comply with NFPA 110, Level 1 Energy Converters. In addition, the equipment engine, skid, cooling system, and alternator shall have been subjected to actual prototype tests to validate the capability of the design under the abnormal conditions noted in NFPA110. Calculations and testing on similar equipment which are allowed under NFPA110 are not sufficient to meet this requirement.
- B. Project-Specific Equipment Tests: Before shipment, factory test engine-generator set manufactured specifically for this Project. Perform tests at rated load and power factor. Include the following tests:
  1. Test engine generator set manufactured for this Project to demonstrate compatibility and functionality.
  2. Full load run.
  3. Maximum power.
  4. Voltage regulation.
  5. Steady-state governing.
  6. Single-step load pickup.
  7. Simulated safety shutdowns.
  8. Provide 14 days' advance notice of tests and opportunity for observation of tests by Owner's representative.

## PART 3 - EXECUTION

### 3.1 INSTALLATION

- A. Comply with packaged engine-generator manufacturers' written installation, application, and alignment instructions and with NFPA 110.

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### 3.2 FIELD QUALITY CONTROL

- A. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect components, assemblies, and equipment installations, including connections, and to assist in testing.

### 3.3 SERVICE AGREEMENT:

- A. The supplier shall include in the base price, a one-year service agreement. The maintenance shall be performed by factory authorized service technicians capable of servicing both the engine-generator set and the transfer switch. This agreement shall include the following:
- B. Generator supplier must have an in-house rental fleet with equipment sized to back up this project site.
- C. All engine maintenance as recommended by the service manual.
- D. All electrical controls maintenance and calibrations as recommended by the manufacturer.
- E. All auxiliary equipment as a part of the emergency systems.
- F. The supplier shall guarantee emergency service.
- G. All expendable maintenance items are to be included in this agreement.
- H. A copy of this agreement and a schedule shall be given to the Owner at the time of his acceptance, showing what work is to be accomplished and when.

END OF SECTION

SECTION 263623

AUTOMATIC TRANSFER SWITCHES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. This Section includes transfer switches rated 600 V and less, including the following:
  - 1. Automatic transfer switches
- B. Related Sections include the following:

1.3 SUBMITTALS

- A. Product Data: For each type of product indicated. Include rated capacities, weights, operating characteristics, furnished specialties, and accessories.
  - 1. Technical data on all major components of all transfer switches and other products described in this section. Data is required for the transfer switch mechanism, control system, cabinet, and protective devices specifically listed for use with each transfer switch. Include steady state and fault current ratings, weights, operating characteristics, and furnished specialties and accessories.
- B. Manufacturer and Supplier Qualification Data
  - 1. The transfer switch manufacturer shall be certified to ISO 9001 International Quality Standard and shall have third party certification verifying quality assurance in design/development, production, installation, and service, in accordance with ISO 9001.
  - 2. The manufacturer of this equipment shall have produced similar equipment for a minimum period of 10 years. When requested, an acceptable list of installations with similar equipment shall be provided demonstrating compliance with this requirement.
- C. Operation and Maintenance Data: For each type of product to include in emergency, operation, and maintenance manuals. In addition to items specified in Division 01 Section "Operation and Maintenance Data," include the following:
  - 1. Features and operating sequences, both automatic and manual.

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2. List of all factory settings of relays, timers and protective devices; provide setting and calibration instructions where applicable.

- D. Warranty documents demonstrating compliance with the project's contract requirements.

### 1.4 QUALITY ASSURANCE

- A. Only approved bidders shall supply equipment provided under this contract.

- B. **Manufacturer Qualifications:** The equipment supplier shall maintain a service center capable of providing training, parts, maintenance and emergency repairs to equipment, including transfer switch generator sets and remote monitoring equipment (if applicable) at the site within a response period of less than (eight hours or appropriate time period designated for Project) from time of notification.

1. The transfer switch shall be serviced by technicians employed by, and specially trained and certified by, the generator set supplier and the supplier shall have a service organization that is factory-certified in both generator set and transfer switch service. The supplier shall maintain an inventory of critical replacement parts at the local service organization, and in service vehicles. The service organization shall be on call 24 hours per day, 365 days per year.
2. Submit names, experience level, training certifications, and locations for technicians that will be responsible for servicing equipment at this site.
3. The manufacturer shall maintain model and serial number records of each transfer switch provided for at least 20 years.

- C. **Source Limitations:** All transfer switches are to be obtained through one source from a single manufacturer. The generator set manufacturer shall warrant transfer switches to provide a single source of responsibility for products provided.

- D. **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 as suitable for use in emergency, legally required or optional standby use as appropriate for the connected load.

- E. The automatic transfer switch installation and application shall conform to the requirements of the following codes and standards:

1. Transfer switches and enclosures shall be UL 1008 listed and labeled as suitable for use in emergency, legally required, and optional standby applications.
2. NFPA 70, National Electrical Code. Equipment shall be suitable for use in systems in compliance with Articles 700, 701 and 702.
3. Comply with NEMA ICS 10-1993 AC Automatic Transfer Switches
4. IBC 2006 – The transfer switch(es) shall be prototype-tested and third-party certified to comply with the requirements of IBC group III or IV, Category D/F. The equipment shall be shipped with the installation instructions necessary to attain installation compliance
5. IEEE 446 – Recommended Practice for Emergency and Standby Power Systems for Commercial and Industrial Applications

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6. IEEE 62.41, AC Voltage Surge Immunity
  7. IEEE 62.45, AC Voltage Surge Testing
- F. Comply with NFPA 110 – Emergency and Standby Power Systems. The transfer switch shall meet all requirements for Level 1 systems, regardless of the actual circuit level.
- G. The manufacturer shall warrant the material and workmanship of the transfer switch equipment for a minimum of one (1) year from registered commissioning and start-up, or eighteen (18) months from date of shipment.
- H. The warranty shall be comprehensive. No deductibles shall be allowed for travel time, service hours, repair parts cost, and etc. during the minimum noted warranty period described above.

### 1.5 PROJECT CONDITIONS

- A. Interruption of Existing Electrical Service: Do not interrupt electrical service to facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary electrical service:
1. Do not proceed with interruption of electrical service without (Architect/Construction Manager/Owner's) written permission.

## PART 2 - PRODUCTS

### 2.1 MANUFACTURERS

- A. 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. Cummins Power Generation
  2. Russelectric
  3. ASCO
- B. Equipment specifications for this Project are based on automatic transfer switches manufactured by Cummins Power Generation. Switches manufactured by Russelectric or ASCO that meet the requirement of this specification are acceptable, if approved not less than two weeks before scheduled bid date. Proposals must include a line-by-line compliance statement based on this specification.
- C. Transfer switches utilizing molded case circuit breakers do not meet the requirements of this specification and will not be accepted.

2.2 GENERAL TRANSFER-SWITCH PRODUCT REQUIREMENTS

- A. Provide transfer switches in the number and ratings that are shown on the drawings. Indicated Current Ratings: Apply as defined in UL 1008 for continuous loading and total system transfer.
- B. Fault-Current Closing and Withstand Ratings: UL 1008 WCR ratings must be specifically listed as meeting the requirements for use with protective devices at installation locations, under specified fault conditions. Withstand and closing ratings shall be based on use of the same set of contacts for the withstand test and the closing test.
- C. Solid-State Controls: All settings should be accurate to +/- 2% or better over an operating temperature range of - 40 to + 60 degrees C (- 40 to + 140 degrees F).
- D. Resistance to Damage by Voltage Transients: Components shall meet or exceed voltage-surge withstand capability requirements when tested according to IEEE C62.41. Components shall meet or exceed voltage-impulse withstand test of NEMA ICS 1.
- E. Electrical Operation: Accomplished by a non-fused, momentarily energized solenoid or electric motor operator mechanism, mechanically and electrically interlocked in both directions (except that mechanical interlock is not required for closed transition switches).
- F. Switch Characteristics: Designed for continuous-duty repetitive transfer of full-rated current between active power sources.
  - 1. Switches using molded-case switches or circuit breakers, or insulated case circuit breaker components are not acceptable.
  - 2. Transfer switches shall be double-throw, electrically and mechanically interlocked, and mechanically held in the Source 1 and Source 2 positions.
  - 3. Main switch contacts shall be high-pressure silver alloy. Contact assemblies shall have arc chutes for positive arc extinguishing. Arc chutes shall have insulating covers to prevent inter-phase flashover.
  - 4. Contacts shall be operated by a high-speed electrical mechanism that causes contacts to open or close within three electrical cycles from signal.
  - 5. The transfer switch operation shall include the ability to switch to an open position (both sources disconnected) for the purpose of load shedding from the generator set.
  - 6. The power transfer mechanism shall include provisions for manual operation under load with the enclosure door closed. Manual operation may be electromechanical or mechanical, but must be coordinated with control function.
  - 7. Transfer switch shall be provided with flame retardant transparent covers to allow viewing of switch contact operation but prevent direct contact with components that could be operating at line voltage levels.
  - 8. The transfer switch shall include the mechanical and control provisions necessary to allow the device to be field-configured for operating speed. Transfer switch operation with motor loads shall be as is recommended in NEMA MG1.
    - a. Phase angle monitoring/timing equipment is not an acceptable substitute for this functionality.

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- G. Control: Transfer switch control shall be capable of communicating with the genset control, other switches and remote programming devices over a high-speed network interface.
- H. Factory wiring: Transfer switch internal wiring shall be composed of pre-manufactured harnesses that are permanently marked for source and destination. Harnesses shall be connected to the control system by means of locking disconnect plug(s), to allow the control system to be easily disconnected and serviced without disconnecting power from the transfer switch mechanism
- I. Terminals: Terminals shall be pressure type and appropriate for all field wiring. Terminal arrangement and cabinet space must be such that feeder conductors can enter from the top, side or bottom of the switch, at the installer’s discretion. Control wiring shall be equipped with suitable lugs, for connection to terminal strips.
- J. Enclosures: All enclosures shall be third-party certified for compliance to NEMA ICS 6 and UL 508, unless otherwise indicated:
  - 1. The enclosure shall provide wire bend space in compliance to the latest version of NFPA70, regardless of the direction from which the conduit enters the enclosure.
  - 2. Exterior cabinet doors shall provide complete protection for the system’s internal components. Doors must have permanently mounted key-type latches. Bolted covers or doors are not acceptable.
  - 3. Transfer switches shall be provided in enclosures that are third party certified for their intended environment per NEMA requirements.
    - a. Transfer switches mounted in a controlled indoor environment shall be provided in NEMA Type 1 enclosures (IEC type IP30).

### 2.3 AUTOMATIC TRANSFER SWITCHES

- A. Comply with requirements for Level 1 equipment according to NFPA 110.
- B. Indicated current ratings:
  - 1. Refer to the Project drawings for specifications on the sizes and types of transfer switch equipment, withstand and closing ratings, number of poles, voltage and ampere ratings, enclosure type, and accessories.
  - 2. Main contacts shall be rated for 600 VAC minimum.
  - 3. Transfer switches shall be rated to carry 100% of rated current continuously in the enclosure supplied, in ambient temperatures of -40 to +60 degrees C (-40 to +140 degrees F), relative humidity up to 95% (non-condensing), and altitudes up to 10,000 feet (3000 meters).
- C. Manual Switch Operation: The power transfer mechanism shall include provisions for manual operation under load with the enclosure door closed. Manual operation may be electromechanical or mechanical, but must be coordinated with control function

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- D. Relay Signal: Control shall include provisions for addition of a pre-transfer relay signal, adjustable from 0 to 60 seconds, to be provided if necessary for elevator operation, based on equipment provided for the project.
- E. Control: Transfer switch control shall be provided with necessary equipment and software to communicate with the genset control, other transfer switches, remote annunciation equipment, and other devices over a high speed control network.
- F. Transfer switches that are designated on the drawings as 3-pole shall be provided with a neutral bus and lugs. The neutral bus shall be sized to carry 100% of the current designated on the switch rating.
- G. The transfer switch physically located closest to the generator and not more than 50 ft (15 meters) away, except those served by generator paralleling equipment, shall be provided with a battery charger suitable for the requirements of the application and in compliance with NFPA 110 requirements for Level 1 systems. If no transfer switch is located within this distance, a battery charger shall be installed on the generator set.
- H. Automatic Transfer Switch Control Features
  - 1. The transfer switch control system shall be configurable in the field for any operating voltage level up to 600 VAC. Voltage sensing shall be monitored based on the normal voltage at the site. Systems that utilize voltage monitoring based on standard voltage conditions that are not field configurable are not acceptable.
  - 2. The transfer switch shall be configurable to accept a relay contact signal and a network signal from an external device for load shedding purposes. On receipt of this signal, the transfer switch shall switch to a neutral position when connected to Source 2. If Source 1 is available when the load-shed signal is received, the transfer switch shall connect to Source 1.
  - 3. The transfer switch shall be configurable to accept a relay contact signal and a network signal from an external device to prevent transfer to the generator service.
  - 4. The transfer switch shall provide a relay contact signal prior to transfer or re-transfer. The time period before and after transfer shall be adjustable in a range of 0 to 50 seconds.
  - 5. The control system shall be designed and prototype tested for operation in ambient temperatures from - 40 degrees C to + 60 degrees C (- 40 to +140 degrees F). It shall be designed and tested to comply with the requirements of the noted voltage and RFI/EMI standards.
  - 6. The control shall have optically isolated logic inputs, high isolation transformers for AC inputs and relays on all outputs, to provide optimum protection from line voltage surges, RFI and EMI.
- I. Transfer Switch Control Panel: The transfer switch shall have a microprocessor-based control with a sealed membrane panel incorporating pushbuttons for operator-controlled functions, and LED lamps for system status indicators. The panel shall also include an alphanumeric display for detailed system information. Panel display and indicating lamps shall include permanent labels.



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1. The indicator panel LEDs shall display:
    - a. Which source the load is connected to (Source 1 or Source 2)
    - b. Which source or sources are available
    - c. When switch is not set for automatic operation, because the control is disabled or the bypass switch is in use
    - d. When the switch is in test/exercise mode
  2. The indicator shall have pushbuttons that allow the operator to activate the following functions:
    - a. Activate pre-programmed test sequence
    - b. Override programmed delays, and immediately go to the next operation
    - c. Reset the control by clearing any faults
    - d. Test all of the LEDs by lighting them simultaneously
  3. The alphanumeric digital display shall be vacuum fluorescent-type, clearly visible in both bright sunlight and no-light conditions over an angle of 120 degrees, and shall display the following:
    - a. AC voltage for all phases, normal and emergency
    - b. Source status: connected or not connected.
    - c. Load data, including voltage, AC current, frequency, KW, KVA, and power factor.
  4. The display panel shall be password-protected, and allow the operator to view and make adjustments:
    - a. Set nominal voltage and frequency for the transfer switch
    - b. Adjust voltage and frequency sensor operation set points
    - c. Set up time clock functions
    - d. Set up load sequence functions
    - e. Enable or disable control functions including program transition
    - f. View real-time clock data, operation log (hours connected, times transferred, failures) and service history.
- J. Control Functions: Functions managed by the control shall include:
1. Software adjustable time delays:
    - a. Engine start (prevents nuisance genset starts in the event of momentary power fluctuation): 0 to 120 seconds (default 3 sec)
    - b. Transfer normal to emergency (allows genset to stabilize before load is transferred): 0 to 120 seconds (default 3 sec)
    - c. Re-transfer emergency to normal (allows utility to stabilize before load is transferred from genset): 0 to 30 minutes (default 3 sec)
    - d. Engine cooldown: 0 to 30 minutes (default 10 min)
    - e. Programmed transition: 0 to 60 seconds (default 3 sec)
  2. Undervoltage sensing: three-phase normal, three-phase emergency source.

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- a. Pickup: 85 to 98% of nominal voltage (default 90%)
  - b. Dropout: 75 to 98% of nominal voltage (default 90%)
  - c. Dropout time delay: 0.1 to 1.0 seconds (default 0.5 sec)
  - d. Accurate to within +/- 1% of nominal voltage
3. Over-voltage sensing: three-phase normal, three-phase emergency source.
    - a. Pickup: 95 to 99% of dropout setting (default 95%)
    - b. Dropout: 105 to 135% of nominal voltage (default 110%)
    - c. Dropout time delay: 0.5 to 120 seconds (default 3 sec)
    - d. Accurate to within +/- 1% of nominal voltage
  4. Over/under frequency sensing:
    - a. Pickup: +/- 5 to +/-20% of nominal frequency (default 10%)
    - b. Dropout: +/-1% beyond pickup (default 1%)
    - c. Dropout time delay: 0.1 to 15.0 seconds (default 5 sec)
    - d. Accurate to within +/- 0.2%
  5. Voltage imbalance sensing:
    - a. Dropout: 2 to 10% (default 4%)
    - b. Pickup: 90% of dropout
    - c. Time delay: 2.0 to 20 seconds (default 5 sec)
  6. Phase rotation sensing:
    - a. Time delay: 100 msec
  7. Loss of single-phase detection:
    - a. Time delay: 100 msec
- K. Control features shall include:
1. Programmable genset exerciser: A field-programmable control shall periodically start the generator, transfer the load to generator for a preset time, then re-transfer and shut down the generator after a preset cool-down period.
    - a. Push-button programming control shall have a selection of eight different schedules for exercising generator, with or without load.
  2. In event of a loss of power to the control, all control settings, real-time clock setting and the engine start-time delay setting will be retained.
  3. The system continuously logs information including the number of hours each source has been connected to the load, the number of times transferred, and the total number of times each source has failed. An event recorder stores information, including time and date-stamp, for up to 50 events.

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4. Transfer Override Switch: Overrides automatic re-transfer control so automatic transfer switch will remain connected to emergency power source regardless of condition of normal source. Pilot light to indicate override status.

### L. Control Interface

1. Provide one set Form C auxiliary contacts on both sides, operated by transfer switch position, rated 10 amps 250 VAC.
2. The transfer switch shall be provided with a network communication card, and configured to allow network-based communication with the transfer switch and other network system components, including the generator set(s) provided for the Project.
3. Unassigned Auxiliary Contacts: Two normally open, 1-pole, double-throw contacts for each switch position, rated 10A at 240 VAC.

### M. Engine Starting Contacts

1. One isolated and normally closed, and one isolated and normally open; rated 10A at 32 VDC minimum.

## PART 3 - EXECUTION

### 3.1 INSTALLATION

- A. Annunciator and Control Panel Mounting: Surface, unless otherwise indicated.
- B. Identify components according to Division 26 Section "Identification for Electrical Systems."
- C. Set field-adjustable intervals and delays, relays, and engine exerciser clock.

### 3.2 CONNECTIONS

- A. Wiring to Remote Components: Match type and number of cables and conductors to control and communication requirements of transfer switches as recommended by manufacturer. Increase raceway sizes at no additional cost to Owner if necessary to accommodate required wiring.
- B. Field control connections shall be made on a common terminal block that is clearly and permanently labeled.
- C. Transfer switch shall be provided with AL/CU mechanical lugs sized to accept the full output rating of the switch. Lugs shall be suitable for the number and size of conductors shown on the drawings.
- D. Ground equipment according to Division 26 Section "Grounding and Bonding for Electrical Systems."

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- E. Connect wiring according to Division 26 Section "Low-Voltage Electrical Power Conductors and Cables."

### 3.3 SOURCE QUALITY CONTROL

- A. Prior to shipping, factory shall test and inspect components, assembled switches, and associated equipment to ensure proper operation.
- B. Factory shall check transfer time and voltage, frequency, and time-delay settings for compliance with specified requirements.
- C. Factory shall perform dielectric strength test complying with NEMA ICS 1.

### 3.4 FIELD QUALITY CONTROL

- A. Manufacturer's Field Service: The supplier of the transfer switch(es) and associated equipment shall inspect, test, and adjust components, assemblies, and equipment installations, including connections, and report results in writing.
- B. Manufacturer's representative shall perform tests and inspections and prepare test reports.
- C. After installing equipment and after electrical circuitry has been energized, installer shall test for compliance with requirements.
  - 1. Perform recommended installation tests as recommended in manufacturer's installation and service manuals.
  - 2. After energizing circuits, demonstrate interlocking sequence and operational function for each switch.
    - a. Simulate power failures of normal source to automatic transfer switches and of emergency source with normal source available.
    - b. Verify time-delay settings.
    - c. Verify that the transfer switch is accurately metering AC voltage and current (when provided).
    - d. Test bypass/isolation unit functional modes and related automatic transfer-switch operations.
    - e. Verify proper sequence and correct timing of automatic engine starting, transfer time delay, retransfer time delay on restoration of normal power, and engine cool-down and shutdown.

### 3.5 DEMONSTRATION

- A. After generator set installation, the generator and transfer switch supplier shall conduct a complete operation, basic maintenance, and emergency service seminar covering generator set and transfer switch equipment, for up to 10 people employed by the Owner.

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1. The seminar shall include instruction on operation of the transfer equipment, normal testing and exercise, adjustments to the control system, use of the PC based service and maintenance tools provided under this contract, and emergency operation procedures.
2. The class duration shall be at least 8 hours in length, and include practical operation with the installed equipment.

END OF SECTION 263623

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### SECTION 264700 - PANELBOARDS

#### PART 1 GENERAL

##### 1.01 WORK INCLUDED

- A. Service and distribution panelboards.

##### 1.02 RELATED WORK

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

##### 1.03 REFERENCES

- A. NECA (National Electrical Contractors Assoc.) "Standard of Installation".
- B. FS W-C-375 - Circuit Breakers, Molded Case, Branch Circuit and Service.
- C. NEMA AB 1 - Molded Case Circuit Breakers.
- D. NEMA KS 1 - Enclosed Switches.
- E. NEMA PB 1 - Panelboards.
- F. NEMA PB 1.1 - Instructions for Safe Installation, Operation and Maintenance of Panelboards Rated 600 Volts or Less.
- G. NEMA PB 1.2 - Application Guide for Ground-Fault Protective Devices for Equipment.
- H. NFPA 70 - National Electrical Code.

##### 1.04 SUBMITTALS

- A. Submit shop drawings for equipment and component devices.
- B. Include outline and support point dimensions, voltage, main bus ampacity, integrated short circuit ampere rating, circuit breaker and fusible switch arrangement and sizes.

##### 1.05 SPARE PARTS

- A. Keys: Furnish 4 each to Owner.

#### PART 2 PRODUCTS

##### 2.01 PANELBOARDS

- A. Main and Distribution Panelboards

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1. Panelboards: NEMA PB 1; circuit breaker type – bolt on.
2. Enclosure: NEMA PB 1; Type 1.
3. Provide cabinet front with concealed trim clamps, screw cover, and hinged door with flush lock. Finish in manufacturer's standard gray enamel.
4. Provide panelboards with aluminum bus, ratings as scheduled on Drawings. Provide copper ground bus in all panelboards.
5. Minimum Integrated Short Circuit Rating: Short circuit rating for LP panels shall be 22,000 AIC. Main Service Circuit Breaker 100,000 AIC or as noted on drawings.
6. Molded Case Circuit Breakers: NEMA AB 1 FS W-C-375; provide circuit breakers with integral thermal and instantaneous magnetic trip in each pole. Provide circuit breakers UL listed as Type HACR for air conditioning equipment branch circuits.
7. Molded Case Circuit Breakers with Current Limiters: NEMA AB 1 FS W-C-375; provide circuit breakers with replaceable current limiting elements, in addition to integral thermal and instantaneous magnetic trip in each pole.
8. Current Limiting Molded Case Circuit Breakers; NEMA AB 1 FS W-C-375; provide circuit breakers with integral thermal and instantaneous magnetic trip in each pole, coordinated with automatically resetting current limiting elements in each pole. Interrupting rating 100,000 symmetrical amperes, let-through current and energy level less than permitted for same size Class RK-5 fuse.
9. Provide circuit breaker accessory trip units and auxiliary contacts as indicated.
10. Install the quantity of corrosion inhibiting compound recommended by manufacturer in all wireways and device enclosures. This includes PVC enclosures where device terminals are exposed to the atmosphere.

### Branch Circuit Panelboards

1. Lighting and Appliance Branch Circuit Panelboards: NEMA PB 1; circuit breaker type. FS W-P-115; Type I, Class 1.
2. Enclosure: NEMA PB 1; Type 1.
3. Cabinet Size: 6 inches deep; 20 inches wide for 240 volt and less panelboards.
4. Provide surface cabinet front with concealed trip clamps, concealed hinge and flush lock all keyed alike. Finish in manufacturer's standard gray enamel.
5. Provide panelboards with aluminum bus, ratings as scheduled on Drawings. Provide copper ground bus in all panelboards.
6. Minimum Integrated Short Circuit Rating: as shown on Drawings.
7. Molded Case Circuit Breakers: NEMA AB 1 FS W-C- 375; bolt-on type thermal magnetic trip circuit breakers, with common trip handle for all poles. Provide circuit breakers UL listed as Type SWD for lighting circuits. Provide UL Class A ground fault interrupter circuit breakers where scheduled on Drawings.
8. Current Limiting Molded Case Circuit Breakers: NEMA AB 1 FS W-C-375; provide circuit breakers with integral thermal and instantaneous magnetic trip in each pole, coordinated with automatically resetting current limiting elements in each pole. Interrupting rating 100,000 symmetrical amperes, let-through current and energy level less than permitted for same size Class RK-5 fuse.
9. Provide circuit breaker accessory trip units and auxiliary contacts as indicated.

## PART 3 EXECUTION

### 3.01 INSTALLATION

#### PANELBOARDS

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- A. Install panelboards plumb and flush with wall finishes, in conformance with NEMA PB 1.1.
- B. Height: 6 feet to top of panelboard maximum.
- C. Provide filler plates for unused spaces in panelboards.
- D. Provide typed or neatly handwritten circuit directory for each branch circuit panelboard. Revise directory to reflect circuiting changes required to balance phase loads. Label Panels per Section 261950.
- E. Provide 6 – 1” EMT conduits from recessed panelboards to accessible point above the ceiling wherever possible.

### 3.02 FIELD QUALITY CONTROL

- A. Measure steady state load currents at each panelboard feeder. Should the difference at any panelboard between phases exceed 20 percent, rearrange circuits in the panelboard to balance the phase loads within 20 percent. Take care to maintain proper phasing for multi-wire branch circuits.
- B. Visual and Mechanical Inspection: Inspect for physical damage, proper alignment, anchorage, and grounding. Check proper installation and tightness of connections for circuit breakers, fusible switches, and fuses.

\*\*\* END OF SECTION \*\*\*



SECTION 265100

INTERIOR LIGHTING

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. Interior lighting fixtures, LEDs and drivers.
  - 2. Emergency lighting units.
  - 3. Exit signs.
  - 4. Lighting fixture supports.

1.3 DEFINITIONS

- A. CCT: Correlated color temperature.
- B. CRI: Color-rendering index.
- C. LER: Luminaire efficacy rating.
- D. Lumen: Measured output of lamp and luminaire, or both.
- E. Luminaire: Complete lighting fixture, including ballast housing if provided.

1.4 ACTION SUBMITTALS

- A. Product Data: For each type of lighting fixture, arranged in order of fixture designation. Include data on features, accessories, finishes, and the following:
  - 1. Physical description of lighting fixture including dimensions.
  - 2. Emergency lighting units including battery and charger.
  - 3. Energy-efficiency data.
  - 4. Life, output (lumens, CCT, and CRI), and energy-efficiency data for lamps.
  - 5. Lamp data including dimensions, color temperature and power consumption
  - 6. Photometric data and adjustment factors based on laboratory tests, complying with IESNA Lighting Measurements Testing & Calculation Guides, of each lighting fixture type.

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The adjustment factors shall be for lamps, ballasts, and accessories identical to those indicated for the lighting fixture as applied in this Project.

- a. Testing Agency Certified Data: For indicated fixtures, photometric data shall be certified by a qualified independent testing agency. Photometric data for remaining fixtures shall be certified by manufacturer.
- b. Manufacturer Certified Data: Photometric data shall be certified by a manufacturer's laboratory with a current accreditation under the National Voluntary Laboratory Accreditation Program for Energy Efficient Lighting Products.

- B. Installation instructions.

### 1.5 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: For lighting equipment and fixtures to include in emergency, operation, and maintenance manuals.
1. Provide a list of all lamp types used on Project; use ANSI and manufacturers' codes.

### 1.6 MAINTENANCE MATERIAL SUBMITTALS

- A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
1. Lamps: 10 of each type and rating installed. Furnish at least one of each type.
  2. Plastic Diffusers and Lenses: One of each type and rating installed. Furnish at least one of each type.
  3. Ballasts: 2 of each type and rating installed. Furnish at least one of each type.
  4. Globes and Guards: 1 of each type and rating installed. Furnish at least one of each type.

### 1.7 QUALITY ASSURANCE

- A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- B. Comply with NFPA 70.

### 1.8 COORDINATION

- A. Coordinate layout and installation of lighting fixtures and suspension system with other construction that penetrates ceilings or is supported by them, including HVAC equipment, fire-suppression system, and partition assemblies.

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### PART 2 - PRODUCTS

#### 2.1 MANUFACTURERS

- A. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, product(s) indicated on Drawings.

#### 2.2 GENERAL REQUIREMENTS FOR LIGHTING FIXTURES AND COMPONENTS

- A. Recessed Fixtures: Comply with NEMA LE 4 for ceiling compatibility for recessed fixtures.
- B. Metal Parts: Free of burrs and sharp corners and edges.
- C. Sheet Metal Components: Steel unless otherwise indicated. Form and support to prevent warping and sagging.
- D. Doors, Frames, and Other Internal Access: Smooth operating, free of light leakage under operating conditions, and designed to permit relamping without use of tools. Designed to prevent doors, frames, lenses, diffusers, and other components from falling accidentally during relamping and when secured in operating position.
- E. Diffusers and Globes:
  - 1. Acrylic Lighting Diffusers: 100 percent virgin acrylic plastic. High resistance to yellowing and other changes due to aging, exposure to heat, and UV radiation.
    - a. Lens Thickness: At least 0.125 inch (3.175 mm) minimum unless otherwise indicated.
    - b. UV stabilized.
  - 2. Glass: Annealed crystal glass unless otherwise indicated.

#### 2.3 LEDs:

- 1. The light source of the luminaires shall consist of LED arrays or bars. If required, the LED arrays or bars shall be removable.
- 2. The LEDs shall be either white or RGB, according to the light fixture schedule and Drawings. For luminaires specified with white light, it is not acceptable to provide RGB LEDs mixed to produce white light.
- 3. Refer to the light fixture schedule and Drawings for the specified correlated color temperature (CCT) of each luminaire.
- 4. Individual LEDs shall be binned by manufacturer to comply with ANSI C78.377.
- 5. The LEDs shall be manufactured by Cree, Philips, Toshiba, Osram, Samsung, or Nichia, unless otherwise noted.

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### 2.4 DRIVERS:

1. The driver or power supply for the luminaire shall be modular and replaceable.
2. The rated life of the driver shall match the rated life of the LEDs and luminaire.
3. In general, the drive current rating of the driver shall be minimized, while still maintaining the required lumen output, to improve luminaire efficiency and life.
4. The driver shall meet the emission standards of IEC EN-61000-6-3 at a minimum. For healthcare or other applications with EMI sensitive equipment, provide drivers that meet more stringent standards as required.

### 2.5 EXIT SIGNS

- A. General Requirements for Exit Signs: Comply with UL 924; for sign colors, visibility, luminance, and lettering size, comply with authorities having jurisdiction.
- B. Internally Lighted Signs:
  1. Lamps for AC Operation: LEDs, 50,000 hours minimum rated lamp life.
  2. Self-Powered Exit Signs (Battery Type): Integral automatic charger in a self-contained power pack.
    - a. Battery: Sealed, maintenance-free, nickel-cadmium type.
    - b. Charger: Fully automatic, solid-state type with sealed transfer relay.
    - c. Operation: Relay automatically energizes lamp from battery when circuit voltage drops to 80 percent of nominal voltage or below. When normal voltage is restored, relay disconnects lamps from battery, and battery is automatically recharged and floated on charger.
    - d. Test Push Button: Push-to-test type, in unit housing, simulates loss of normal power and demonstrates unit operability.
    - e. LED Indicator Light: Indicates normal power on. Normal glow indicates trickle charge; bright glow indicates charging at end of discharge cycle.

### 2.6 EMERGENCY LIGHTING UNITS

- A. General Requirements for Emergency Lighting Units: Self-contained units complying with UL 924.
  1. Battery: Sealed, maintenance-free, lead-acid type.
  2. Charger: Fully automatic, solid-state type with sealed transfer relay.
  3. Operation: Relay automatically turns lamp on when power-supply circuit voltage drops to 80 percent of nominal voltage or below. Lamp automatically disconnects from battery when voltage approaches deep-discharge level. When normal voltage is restored, relay disconnects lamps from battery, and battery is automatically recharged and floated on charger.
  4. Test Push Button: Push-to-test type, in unit housing, simulates loss of normal power and demonstrates unit operability.

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5. LED Indicator Light: Indicates normal power on. Normal glow indicates trickle charge; bright glow indicates charging at end of discharge cycle.

### PART 3 - EXECUTION

#### 3.1 INSTALLATION

##### A. Lighting fixtures:

1. Set level, plumb, and square with ceilings and walls unless otherwise indicated.
2. Install lamps in each luminaire.

##### B. Temporary Lighting: If it is necessary, and approved by Architect, to use permanent luminaires for temporary lighting, install and energize the minimum number of luminaires necessary. When construction is sufficiently complete, remove the temporary luminaires, disassemble, clean thoroughly, install new lamps, and reinstall.

##### C. Suspended Lighting Fixture Support:

1. Pendants and Rods: Where longer than 48 inches (1200 mm), brace to limit swinging.
2. Stem-Mounted, Single-Unit Fixtures: Suspend with twin-stem hangers.
3. Continuous Rows: Use tubing or stem for wiring at one point and tubing or rod for suspension for each unit length of fixture chassis, including one at each end.
4. Do not use grid as support for pendant luminaires. Connect support wires or rods to building structure.

##### D. Connect wiring according to Section 260519 "Low-Voltage Electrical Power Conductors and Cables."

#### 3.2 IDENTIFICATION

##### A. Install labels with panel and circuit numbers on concealed junction and outlet boxes. Comply with requirements for identification specified in Section 260553 "Identification for Electrical Systems."

#### 3.3 FIELD QUALITY CONTROL

##### A. Test for Emergency Lighting: Interrupt power supply to demonstrate proper operation. Verify transfer from normal power to battery and retransfer to normal.

#### 3.4 STARTUP SERVICE

##### A. Burn-in all lamps that require specific aging period to operate properly, prior to occupancy by Owner. Burn-in fluorescent and compact fluorescent lamps intended to be dimmed, for at least 100 hours at full voltage.

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### 3.5 ADJUSTING

- A. Occupancy Adjustments: When requested within 12 months of date of Substantial Completion, provide on-site assistance in adjusting aimable luminaires to suit actual occupied conditions. Provide up to two visits to Project during other-than-normal occupancy hours for this purpose. Some of this work may be required after dark.
  - 1. Adjust aimable luminaires in the presence of Architect.

END OF SECTION 265100

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### SECTION 271100 COMMUNICATIONS EQUIPMENT ROOM FITTINGS

#### PART 1 - GENERAL

##### 1.1 RELATED DOCUMENTS

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

##### 1.2 SUMMARY

- A. Section Includes:
  - 1. Telecommunications mounting elements.
  - 2. Telecommunications equipment racks.
  - 3. Grounding.
- B. Related Requirements:
  - 1. Section 271500 "Communications Horizontal Cabling" for voice and data cabling associated with system panels and devices.

##### 1.3 DEFINITIONS

- A. BICSI: Building Industry Consulting Service International.
- B. LAN: Local area network.
- C. RCDD: Registered Communications Distribution Designer.

##### 1.4 ACTION SUBMITTALS

- A. Product Data: For each type of product.
  - 1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for equipment racks.
  - 2. Include rated capacities, operating characteristics, electrical characteristics, and furnished specialties and accessories.

##### 1.5 QUALITY ASSURANCE

- A. Installer Qualifications: Cabling Installer must have personnel certified by BICSI on staff.

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1. Layout Responsibility: Preparation of Shop Drawings and Cabling Administration Drawings and RCDD.
2. Installation Supervision: Installation shall be under the direct supervision of Registered Technician, who shall be present at all times when Work of this Section is performed at Project site.

### 1.6 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For Installer, qualified layout technician, installation supervisor, and field inspector.

## PART 2 - PRODUCTS

### 2.1 EQUIPMENT FRAMES

- A. Manufacturers: Subject to compliance with requirements, provide products by the following:
  1. Belden Inc.
  2. Cooper B-Line.
  3. Emerson Network Power Connectivity Solutions.
  4. Hubbell Premise Wiring.
  5. Leviton Commercial Networks Division.
  6. Middle Atlantic Products, Inc.
  7. Ortronics, Inc.
  8. Panduit Corp.
  9. Siemon Co. (The).
  10. Tyco Electronics Corporation; AMP Products.
- B. General Frame Requirements:
  1. Distribution Frames: Freestanding and wall-mounting, modular-steel units designed for telecommunications terminal support and coordinated with dimensions of units to be supported.
  2. Module Dimension: Width compatible with EIA 310-D standard, 19-inch (480-mm) panel mounting.
  3. Finish: Manufacturer's standard, baked-polyester powder coat.
- C. Floor-Mounted Racks: Modular-type, steel construction.
  1. Vertical and horizontal cable management channels, top and bottom cable troughs, grounding lug, and a power strip.
  2. Baked-polyester powder coat finish.
- D. Cable Management for Equipment Frames:
  1. Metal, with integral wire retaining fingers.



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2. Baked-polyester powder coat finish.
3. Vertical cable management panels shall have front and rear channels, with covers.
4. Provide horizontal crossover cable manager at the top of each relay rack, with a minimum height of two rack units each.

### 2.2 POWER STRIPS

#### A. Power Strips: Comply with UL 1363.

1. Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
2. Rack mounting.
3. Six 20-A, 120-V ac, NEMA WD 6, Configuration 5-20R receptacles.
4. LED indicator lights for power and protection status.
5. LED indicator lights for reverse polarity and open outlet ground.
6. Circuit Breaker and Thermal Fusing: When protection is lost, circuit opens and cannot be reset.
7. Circuit Breaker and Thermal Fusing: Unit continues to supply power if protection is lost.
8. Close-coupled, direct plug-in line cord.
9. Rocker-type on-off switch, illuminated when in on position.
10. Peak Single-Impulse Surge Current Rating: 33 kA per phase.
11. Protection modes shall be line to neutral, line to ground, and neutral to ground. UL 1449 clamping voltage for all three modes shall be not more than 330 V.

### 2.3 GROUNDING

#### A. Comply with requirements in Section "Grounding and Bonding" for grounding conductors and connectors.

#### B. Telecommunications Main Bus Bar:

1. Connectors: Mechanical type, cast silicon bronze, solderless compression-type wire terminals, and long-barrel, two-bolt connection to ground bus bar.
2. Ground Bus Bar: Copper, minimum 1/4 inch thick by 4 inches wide (6 mm thick by 100 mm wide) with 9/32-inch (7.14-mm) holes spaced 1-1/8 inches (28 mm) apart.
3. Stand-Off Insulators: Comply with UL 891 for use in switchboards, 600 V. Lexan or PVC, impulse tested at 5000 V.

#### C. Comply with J-STD-607-A.

### 2.4 LABELING

#### A. Comply with TIA/EIA-606-A and UL 969 for a system of labeling materials, including label stocks, laminating adhesives, and inks used by label printers.

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### PART 3 - EXECUTION

#### 3.1 INSTALLATION

- A. Comply with NECA 1.
- B. Comply with BICSI TDMM for layout and installation of communications equipment rooms.
- C. Bundle, lace, and train conductors and cables to terminal points without exceeding manufacturer's limitations on bending radii. Install lacing bars and distribution spools.
- D. Coordinate layout and installation of communications equipment with Owner's telecommunications and LAN equipment and service suppliers. Coordinate service entrance arrangement with local exchange carrier.
  - 1. Meet jointly with telecommunications and LAN equipment suppliers, local exchange carrier representatives, and Owner to exchange information and agree on details of equipment arrangements and installation interfaces.
  - 2. Record agreements reached in meetings and distribute them to other participants.
  - 3. Adjust arrangements and locations of distribution frames, cross-connects, and patch panels in equipment rooms to accommodate and optimize arrangement and space requirements of telephone switch and LAN equipment.
  - 4. Adjust arrangements and locations of equipment with distribution frames, cross-connects, and patch panels of cabling systems of other communications, electronic safety and security, and related systems that share space in the equipment room.
- E. Coordinate location of power raceways and receptacles with locations of communications equipment requiring electrical power to operate.

#### 3.2 FIRESTOPPING

- A. Comply with TIA-569-B, Annex A, "Firestopping."
- B. Comply with BICSI TDMM, "Firestopping Systems" Article.

#### 3.3 GROUNDING

- A. Install grounding according to BICSI TDMM, "Grounding, Bonding, and Electrical Protection" Chapter.
- B. Comply with J-STD-607-A.
- C. Locate grounding bus bar to minimize the length of bonding conductors. Fasten to wall allowing at least 2-inch (50-mm) clearance behind the grounding bus bar. Connect grounding bus bar with a minimum No. 4 AWG grounding electrode conductor from grounding bus bar to suitable electrical building ground.

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- D. Bond metallic equipment to the grounding bus bar, using not smaller than No. 6 AWG equipment grounding conductor.
  - 1. Bond the shield of shielded cable to the grounding bus bar in communications rooms and spaces.

### 3.4 IDENTIFICATION

- A. Identify system components, wiring, and cabling complying with TIA/EIA-606-A. Comply with requirements in Section "Identification for Electrical Systems."
- B. Labels shall be preprinted or computer-printed type.

END OF SECTION 271100

SECTION 271500 - COMMUNICATIONS HORIZONTAL CABLING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section Includes:
  - 1. UTP cabling.
  - 2. Coaxial Cable
  - 3. Cable connecting hardware, patch panels, and cross-connects.
  - 4. Telecommunications outlet/connectors.
  - 5. Cabling system identification products.

1.3 DEFINITIONS

- A. BICSI: Building Industry Consulting Service International.
- B. Cross-Connect: A facility enabling the termination of cable elements and their interconnection or cross-connection.
- C. EMI: Electromagnetic interference.
- D. IDC: Insulation displacement connector.
- E. LAN: Local area network.
- F. Outlet/Connectors: A connecting device in the work area on which horizontal cable or outlet cable terminates.
- G. RCDD: Registered Communications Distribution Designer.
- H. UTP: Unshielded twisted pair.

1.4 ADMINISTRATIVE REQUIREMENTS

- A. Coordinate layout and installation of telecommunications cabling with Owner's telecommunications and LAN equipment and service suppliers.

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- B. Coordinate telecommunications outlet/connector locations with location of power receptacles at each work area.

### 1.5 ACTION SUBMITTALS

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

### 1.6 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For Installer, qualified layout technician, installation supervisor, and field inspector.
- B. Source quality-control reports.
- C. Field quality-control reports.

### 1.7 MAINTENANCE MATERIAL SUBMITTALS

- A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
  - 1. Patch-Panel Units: One of each type.
  - 2. Connecting Blocks: One of each type.
  - 3. Device Plates: One of each type.

### 1.8 QUALITY ASSURANCE

- A. Installer Qualifications: Cabling Installer must have personnel certified by BICSI on staff.
  - 1. Layout Responsibility: Preparation of Shop Drawings and Cabling Administration Drawings and RCDD.
  - 2. Installation Supervision: Installation shall be under the direct supervision of Registered Technician, who shall be present at all times when Work of this Section is performed at Project site.
  - 3. Testing Supervisor: Currently certified by BICSI as an RCDD to supervise on-site testing.

### 1.9 DELIVERY, STORAGE, AND HANDLING

- A. Test cables upon receipt at Project site.
  - 1. Test each pair of UTP cable for open and short circuits.

PART 2 - PRODUCTS

2.1 HORIZONTAL CABLING DESCRIPTION

- A. Horizontal cable and its connecting hardware provide the means of transporting signals between the telecommunications outlet/connector and the horizontal cross-connect located in the communications equipment room. This cabling and its connecting hardware are called a "permanent link," a term that is used in the testing protocols.
  - 1. TIA/EIA-568-B.1 requires that a minimum of two telecommunications outlet/connectors be installed for each work area.
  - 2. Horizontal cabling shall contain no more than one transition point or consolidation point between the horizontal cross-connect and the telecommunications outlet/connector.
  - 3. Bridged taps and splices shall not be installed in the horizontal cabling.
- B. The maximum allowable horizontal cable length is 295 feet (90 m). This maximum allowable length does not include an allowance for the length of 16 feet (4.9 m) to the workstation equipment or in the horizontal cross-connect.

2.2 PERFORMANCE REQUIREMENTS

- A. General Performance: Horizontal cabling system shall comply with transmission standards in TIA/EIA-568-B.1 when tested according to test procedures of this standard.
- B. Surface-Burning Characteristics: Comply with ASTM E 84; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.
  - 1. Flame-Spread Index: 25 or less.
  - 2. Smoke-Developed Index: 50 or less.
- C. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- D. Grounding: Comply with J-STD-607-A.

2.3 UTP CABLE

- A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
  - 1. ADC.
  - 2. Belden Inc.
  - 3. Berk-Tek; a Nexans company.
  - 4. CommScope, Inc.
  - 5. Draka Cableteq USA.
  - 6. Genesis Cable Products; Honeywell International, Inc.

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7. Mohawk; a division of Belden Networking, Inc.
8. Superior Essex Inc.
9. SYSTIMAX Solutions; a CommScope, Inc. brand.
10. 3M Communication Markets Division.
11. Tyco Electronics Corporation; AMP Products.

B. Description: 100-ohm, four-pair UTP, covered with a blue thermoplastic jacket.

1. Comply with ICEA S-90-661 for mechanical properties.
2. Comply with TIA/EIA-568-B.1 for performance specifications.
3. Comply with TIA/EIA-568-B.2, **Category 6**.
4. Listed and labeled by an NRTL acceptable to authorities having jurisdiction as complying with UL 444 and NFPA 70 for the following types:
  - a. Communications, General Purpose: Type CM or CMG.
  - b. Communications, Plenum Rated: Type CMP, complying with NFPA 262.
  - c. Communications, Riser Rated: Type CMR, complying with UL 1666.
  - d. Communications, Limited Purpose: Type CMX.
  - e. Multipurpose: Type MP or MPG.
  - f. Multipurpose, Plenum Rated: Type MPP, complying with NFPA 262.
  - g. Multipurpose, Riser Rated: Type MPR, complying with UL 1666.

### 2.4 UTP CABLE HARDWARE

A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

1. ADC.
2. American Technology Systems Industries, Inc.
3. Belden Inc.
4. Dynacom Inc.
5. Hubbell Premise Wiring.
6. Leviton Commercial Networks Division.
7. Molex Premise Networks; a division of Molex, Inc.
8. Panduit Corp.
9. Siemon Co. (The).
10. Tyco Electronics Corporation; AMP Products.

B. General Requirements for Cable Connecting Hardware: Comply with TIA/EIA-568-B.2, IDC type, with modules designed for punch-down caps or tools. Cables shall be terminated with connecting hardware of same category or higher.

C. Connecting Blocks: 110-style IDC for **Category 6**. Provide blocks for the number of cables terminated on the block, plus 25 percent spare. Integral with connector bodies, including plugs and jacks where indicated.

D. Cross-Connect: Modular array of connecting blocks arranged to terminate building cables and permit interconnection between cables.

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- E. Patch Panel: Modular panels housing multiple-numbered jack units with IDC-type connectors at each jack for permanent termination of pair groups of installed cables.
- F. Jacks and Jack Assemblies: Modular, color-coded, eight-position modular receptacle units with integral IDC-type terminals.
  - 1. Patch cords shall have bend-relief-compliant boots and color-coded icons to ensure **Category 6** performance. Patch cords shall have latch guards to protect against snagging.

### 2.5 COAXIAL CABLE

- A. The drop cable shall be plenum rated RG-6U with 100% shielding. The cable shall be West Penn Wire 25841, or approved equal.

### 2.6 TELECOMMUNICATIONS OUTLET/CONNECTORS

- A. Jacks: 100-ohm, balanced, twisted-pair connector; four-pair, eight-position modular. Comply with TIA/EIA-568-B.1.
- B. Workstation Outlets: Port-connector assemblies, with quantities shown on drawings, mounted in single faceplate.
  - 1. Plastic Faceplate: High-impact plastic. Coordinate color with Section 262726 "Wiring Devices."
  - 2. For use with snap-in jacks accommodating any combination of UTP.
  - 3. Legend: Machine printed, in the field, using adhesive-tape label.
  - 4. Legend: Snap-in, clear-label covers and machine-printed paper inserts.

### 2.7 GROUNDING

- A. Comply with requirements in Section 260526 "Grounding and Bonding for Electrical Systems" for grounding conductors and connectors.
- B. Comply with J-STD-607-A.

### 2.8 IDENTIFICATION PRODUCTS

- A. Comply with TIA/EIA-606-A and UL 969 for labeling materials, including label stocks, laminating adhesives, and inks used by label printers.
- B. Comply with requirements in Section 260553 "Identification for Electrical Systems."



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### PART 3 - EXECUTION

#### 3.1 WIRING METHODS

- A. Install cables in pathways and cable trays except within consoles, cabinets, desks, and counters and except in accessible ceiling spaces and in gypsum board partitions where unenclosed wiring method may be used. Conceal pathways and cables except in unfinished spaces.
  - 1. Install plenum cable in environmental air spaces, including plenum ceilings.
- B. Conceal conductors and cables in accessible ceilings, walls, and floors where possible.
- C. Wiring within Enclosures:
  - 1. Bundle, lace, and train conductors to terminal points with no excess and without exceeding manufacturer's limitations on bending radii.
  - 2. Install lacing bars and distribution spools.
  - 3. Install conductors parallel with or at right angles to sides and back of enclosure.

#### 3.2 INSTALLATION OF CABLES

- A. Comply with NECA 1.
- B. General Requirements for Cabling:
  - 1. Comply with TIA/EIA-568-B.1.
  - 2. Comply with BICSI ITSIM, Ch. 6, "Cable Termination Practices."
  - 3. Install 110-style IDC termination hardware unless otherwise indicated.
  - 4. Terminate conductors; no cable shall contain unterminated elements. Make terminations only at indicated outlets, terminals, cross-connects, and patch panels.
  - 5. Cables may not be spliced. Secure and support cables at intervals not exceeding 30 inches (760 mm) and not more than 6 inches (150 mm) from cabinets, boxes, fittings, outlets, racks, frames, and terminals.
  - 6. Install lacing bars to restrain cables, to prevent straining connections, and to prevent bending cables to smaller radii than minimums recommended by manufacturer.
  - 7. Bundle, lace, and train conductors to terminal points without exceeding manufacturer's limitations on bending radii, but not less than radii specified in BICSI ITSIM, "Cabling Termination Practices" Chapter. Install lacing bars and distribution spools.
  - 8. Do not install bruised, kinked, scored, deformed, or abraded cable. Do not splice cable between termination, tap, or junction points. Remove and discard cable if damaged during installation and replace it with new cable.
  - 9. In the communications equipment room, install a 10-foot- (3-m-) long service loop on each end of cable.
  - 10. Pulling Cable: Comply with BICSI ITSIM, Ch. 4, "Pulling Cable." Monitor cable pull tensions.

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- C. UTP Cable Installation:
  - 1. Comply with TIA/EIA-568-B.2.
  - 2. Do not untwist UTP cables more than 1/2 inch (12 mm) from the point of termination to maintain cable geometry.
  
- D. Open-Cable Installation:
  - 1. Install cabling with horizontal and vertical cable guides in telecommunications spaces with terminating hardware and interconnection equipment.
  - 2. Suspend UTP cable not in a wireway or pathway a minimum of 8 inches (200 mm) above ceilings by cable supports not more than 60 inches (1524 mm) apart.
  - 3. Cable shall not be run through structural members or in contact with pipes, ducts, or other potentially damaging items.
  
- E. Group connecting hardware for cables into separate logical fields.
  
- F. Separation from EMI Sources:
  - 1. Comply with BICSI TDMM and TIA-569-B for separating unshielded copper voice and data communication cable from potential EMI sources, including electrical power lines and equipment.
  - 2. Separation between open communications cables or cables in nonmetallic raceways and unshielded power conductors and electrical equipment shall be as follows:
    - a. Electrical Equipment Rating Less Than 2 kVA: A minimum of 5 inches (127 mm).
    - b. Electrical Equipment Rating between 2 and 5 kVA: A minimum of 12 inches (300 mm).
    - c. Electrical Equipment Rating More Than 5 kVA: A minimum of 24 inches (610 mm).
  - 3. Separation between communications cables in grounded metallic raceways and unshielded power lines or electrical equipment shall be as follows:
    - a. Electrical Equipment Rating Less Than 2 kVA: A minimum of 2-1/2 inches (64 mm).
    - b. Electrical Equipment Rating between 2 and 5 kVA: A minimum of 6 inches (150 mm).
    - c. Electrical Equipment Rating More Than 5 kVA: A minimum of 12 inches (300 mm).
  - 4. Separation between communications cables in grounded metallic raceways and power lines and electrical equipment located in grounded metallic conduits or enclosures shall be as follows:
    - a. Electrical Equipment Rating Less Than 2 kVA: No requirement.
    - b. Electrical Equipment Rating between 2 and 5 kVA: A minimum of 3 inches (76 mm).
    - c. Electrical Equipment Rating More Than 5 kVA: A minimum of 6 inches (150 mm).

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5. Separation between Communications Cables and Electrical Motors and Transformers, 5 kVA or HP and Larger: A minimum of 48 inches (1200 mm).
6. Separation between Communications Cables and Fluorescent Fixtures: A minimum of 5 inches (127 mm).

### 3.3 FIRESTOPPING

- A. Comply with requirements in Section 078413 "Penetration Firestopping."
- B. Comply with TIA-569-B, Annex A, "Firestopping."
- C. Comply with BICSI TDMM, "Firestopping Systems" Article.

### 3.4 GROUNDING

- A. Install grounding according to BICSI TDMM, "Grounding, Bonding, and Electrical Protection" Chapter.
- B. Comply with J-STD-607-A.
- C. Locate grounding bus bar to minimize the length of bonding conductors. Fasten to wall allowing at least 2-inch (50-mm) clearance behind the grounding bus bar. Connect grounding bus bar with a minimum No. 4 AWG grounding electrode conductor from grounding bus bar to suitable electrical building ground.
- D. Bond metallic equipment to the grounding bus bar, using not smaller than No. 6 AWG equipment grounding conductor.

### 3.5 IDENTIFICATION

- A. Identify system components, wiring, and cabling complying with TIA/EIA-606-A. Comply with requirements for identification specified in Section "Identification for Electrical Systems."
- B. Cable Schedule: Post in prominent location in each equipment room and wiring closet. List incoming and outgoing cables and their designations, origins, and destinations. Protect with rigid frame and clear plastic cover. Furnish an electronic copy of final comprehensive schedules for Project.
- C. Cabling Administration Drawings: Show building floor plans with cabling administration-point labeling. Identify labeling convention and show labels for telecommunications closets, terminal hardware and positions, horizontal cables, work areas and workstation terminal positions, grounding buses and pathways, and equipment grounding conductors. Follow convention of TIA/EIA-606-A. Furnish electronic record of all drawings, in software and format selected by Owner.
- D. Cable and Wire Identification:

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1. Label each cable within 4 inches (100 mm) of each termination and tap, where it is accessible in a cabinet or junction or outlet box, and elsewhere as indicated.
  2. Each wire connected to building-mounted devices is not required to be numbered at device if color of wire is consistent with associated wire connected and numbered within panel or cabinet.
  3. Exposed Cables and Cables in Cable Trays and Wire Troughs: Label each cable at intervals not exceeding 15 feet (4.5 m).
  4. Label each terminal strip and screw terminal in each cabinet, rack, or panel.
    - a. Individually number wiring conductors connected to terminal strips, and identify each cable or wiring group being extended from a panel or cabinet to a building-mounted device shall be identified with name and number of particular device as shown.
    - b. Label each unit and field within distribution racks and frames.
  5. Identification within Connector Fields in Equipment Rooms and Wiring Closets: Label each connector and each discrete unit of cable-terminating and connecting hardware. Where similar jacks and plugs are used for both voice and data communication cabling, use a different color for jacks and plugs of each service.
- E. Labels shall be preprinted or computer-printed type with printing area and font color that contrasts with cable jacket color but still complies with requirements in TIA/EIA-606-A.
1. Cables use flexible vinyl or polyester that flex as cables are bent.

### 3.6 FIELD QUALITY CONTROL

- A. Perform the following tests and inspections:
1. Visually inspect UTP and optical fiber cable jacket materials for NRTL certification markings. Inspect cabling terminations in communications equipment rooms for compliance with color-coding for pin assignments, and inspect cabling connections for compliance with TIA/EIA-568-B.1.
  2. Visually confirm **Category 6**, marking of outlets, cover plates, outlet/connectors, and patch panels.
  3. Visually inspect cable placement, cable termination, grounding and bonding, equipment and patch cords, and labeling of all components.
- B. End-to-end cabling will be considered defective if it does not pass tests and inspections.
- C. Prepare test and inspection reports.

END OF SECTION 271500

SECTION 283111 - DIGITAL, ADDRESSABLE FIRE-ALARM SYSTEM

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Fire-alarm control unit.
2. Manual fire-alarm boxes.
3. System smoke detectors.
4. Heat detectors.
5. Notification appliances.
6. Remote annunciator.
7. Addressable interface device.
8. Digital alarm communicator transmitter.

1.2 SYSTEM DESCRIPTION

- A. Noncoded, addressable system, with multiplexed signal transmission, dedicated to fire-alarm service only.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Shop Drawings: For fire-alarm system. Include plans, elevations, sections, details, and attachments to other work.
1. Comply with recommendations in the "Documentation" Section of the "Fundamentals of Fire Alarm Systems" Chapter in NFPA 72.
  2. Include voltage drop calculations for notification appliance circuits.
  3. Include battery-size calculations.
  4. Include performance parameters and installation details for each detector, verifying that each detector is listed for complete range of air velocity, temperature, and humidity possible when air-handling system is operating.
  5. Include plans, sections, and elevations of heating, ventilating, and air-conditioning ducts, drawn to scale and coordinating installation of duct smoke detectors and access to them. Show critical dimensions that relate to placement and support of sampling tubes, detector housing, and remote status and alarm indicators. Locate detectors according to manufacturer's written recommendations.
  6. Include floor plans to indicate final outlet locations showing address of each addressable device. Show size and route of cable and conduits.

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### C. General Submittal Requirements:

1. Submittals shall be approved by authorities having jurisdiction prior to submitting them to Architect.
2. Shop Drawings shall be prepared by persons with the following qualifications:
  - a. Trained and certified by manufacturer in fire-alarm system design.
  - b. NICET-certified fire-alarm technician, Level III minimum.

### D. Delegated-Design Submittal: For smoke and heat detectors indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

1. Drawings showing the location of each smoke and heat detector, ratings of each, and installation details as needed to comply with listing conditions of the detector.
2. Design Calculations: Calculate requirements for selecting the spacing and sensitivity of detection, complying with NFPA 72.

## 1.4 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For qualified Installer.
- B. Field quality-control reports.

## 1.5 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: For fire-alarm systems and components to include in emergency, operation, and maintenance manuals.
  1. Comply with the "Records" Section of the "Inspection, Testing and Maintenance" Chapter in NFPA 72.
  2. Provide "Record of Completion Documents" according to NFPA 72 article "Permanent Records" in the "Records" Section of the "Inspection, Testing and Maintenance" Chapter.
  3. Record copy of site-specific software.
  4. Provide "Maintenance, Inspection and Testing Records" according to NFPA 72 article of the same name and include the following:
    - a. Frequency of testing of installed components.
    - b. Frequency of inspection of installed components.
    - c. Requirements and recommendations related to results of maintenance.
    - d. Manufacturer's user training manuals.
  5. Manufacturer's required maintenance related to system warranty requirements.
  6. Abbreviated operating instructions for mounting at fire-alarm control unit.
- B. Software and Firmware Operational Documentation:

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1. Software operating and upgrade manuals.
2. Program Software Backup: On magnetic media or compact disk, complete with data files.
3. Device address list.
4. Printout of software application and graphic screens.

### 1.6 QUALITY ASSURANCE

- A. Installer Qualifications: Personnel shall be trained and certified by manufacturer for installation of units required for this Project.
- B. Installer Qualifications: Installation shall be by personnel certified by NICET as fire-alarm Level II technician.
- C. Source Limitations for Fire-Alarm System and Components: Obtain fire-alarm system from single source from single manufacturer. Components shall be compatible with, and operate as, an extension of existing system.
- D. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

### 1.7 SOFTWARE SERVICE AGREEMENT

- A. Comply with UL 864.
- B. Technical Support: Beginning with Substantial Completion, provide software support for two years.
- C. Upgrade Service: Update software to latest version at Project completion. Install and program software upgrades that become available within two years from date of Substantial Completion. Upgrading software shall include operating system. Upgrade shall include new or revised licenses for use of software.
  1. Provide 30 days' notice to Owner to allow scheduling and access to system and to allow Owner to upgrade computer equipment if necessary.

## PART 2 - PRODUCTS

### 2.1 SYSTEMS OPERATIONAL DESCRIPTION

- A. Fire-alarm signal initiation shall be by one or more of the following devices:
  1. Manual stations.
  2. Heat detectors.
  3. Smoke detectors.
  4. Duct smoke detectors.

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5. Automatic sprinkler system water flow.
- B. Fire-alarm signal shall initiate the following actions:
1. Continuously operate alarm-notification appliances.
  2. Identify alarm at the fire-alarm control unit and remote annunciators.
  3. Transmit an alarm signal to the remote alarm receiving station.
  4. Switch heating, ventilating, and air-conditioning equipment controls to fire-alarm mode.
  5. Record events in the system memory.
  6. Actuate Fire/Smoke Dampers associated with duct smoke detectors.
- C. Supervisory signal initiation shall be by one or more of the following devices and actions:
1. Valve supervisory switch.
- D. System trouble signal initiation shall be by one or more of the following devices and actions:
1. Open circuits, shorts, and grounds in designated circuits.
  2. Opening, tampering with, or removing alarm-initiating and supervisory signal-initiating devices.
  3. Loss of primary power at fire-alarm control unit.
  4. Ground or a single break in fire-alarm control unit internal circuits.
  5. Abnormal ac voltage at fire-alarm control unit.
  6. Break in standby battery circuitry.
  7. Failure of battery charging.
  8. Abnormal position of any switch at fire-alarm control unit or annunciator.
- E. System Trouble and Supervisory Signal Actions: Initiate notification appliance and annunciate at fire-alarm control unit and remote annunciators.

### 2.2 FIRE-ALARM CONTROL UNIT

- A. General Requirements for Fire-Alarm Control Unit:
1. Field-programmable, microprocessor-based, modular, power-limited design with electronic modules, complying with UL 864 and listed and labeled by an NRTL.
    - a. System software and programs shall be held in flash electrically erasable programmable read-only memory (EEPROM), retaining the information through failure of primary and secondary power supplies.
    - b. Include a real-time clock for time annotation of events on the event recorder and printer.
  2. Addressable control circuits for operation of mechanical equipment.
- B. Alphanumeric Display and System Controls: Arranged for interface between human operator at fire-alarm control unit and addressable system components including annunciation and



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supervision. Display alarm, supervisory, and component status messages and the programming and control menu.

1. Annunciator and Display: Liquid-crystal type, 3 line(s) of 80 characters, minimum.
2. Keypad: Arranged to permit entry and execution of programming, display, and control commands.

### C. Circuits:

1. Initiating Device, Notification Appliance, and Signaling Line Circuits: NFPA 72, Class A.
  - a. Initiating Device Circuits: Style D.
  - b. Notification Appliance Circuits: Style Z.
  - c. Signaling Line Circuits: Style 6.
  - d. Install no more than 50 addressable devices on each signaling line circuit.

D. Door Controls: Door hold-open devices that are controlled by smoke detectors at doors in smoke barrier walls shall be connected to fire-alarm system.

E. Transmission to Remote Alarm Receiving Station: Automatically transmit alarm, supervisory, and trouble signals to a remote alarm station.

F. Primary Power: 24-V dc obtained from 120-V ac service and a power-supply module. Initiating devices, notification appliances, signaling lines, trouble signals, and supervisory signals shall be powered by 24-V dc source.

1. Alarm current draw of entire fire-alarm system shall not exceed 80 percent of the power-supply module rating.

G. Secondary Power: 24-V dc supply system with batteries, automatic battery charger, and automatic transfer switch.

1. Batteries: Sealed lead calcium.

H. Instructions: Computer printout or typewritten instruction card mounted behind a plastic or glass cover in a stainless-steel or aluminum frame. Include interpretation and describe appropriate response for displays and signals. Briefly describe the functional operation of the system under normal, alarm, and trouble conditions.

## 2.3 MANUAL FIRE-ALARM BOXES

A. General Requirements for Manual Fire-Alarm Boxes: Comply with UL 38. Boxes shall be finished in red with molded, raised-letter operating instructions in contrasting color; shall show visible indication of operation; and shall be mounted on recessed outlet box. If indicated as surface mounted, provide manufacturer's surface back box.

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1. Double-action mechanism requiring two actions to initiate an alarm, pull-lever type; with integral addressable module arranged to communicate manual-station status (normal, alarm, or trouble) to fire-alarm control unit.
2. Station Reset: Key- or wrench-operated switch.

### 2.4 SYSTEM SMOKE DETECTORS

#### A. General Requirements for System Smoke Detectors:

1. Comply with UL 268; operating at 24-V dc, nominal.
2. Detectors shall be four-wire type.
3. Integral Addressable Module: Arranged to communicate detector status (normal, alarm, or trouble) to fire-alarm control unit.
4. Base Mounting: Detector and associated electronic components shall be mounted in a twist-lock module that connects to a fixed base. Provide terminals in the fixed base for connection to building wiring.
5. Self-Restoring: Detectors do not require resetting or readjustment after actuation to restore them to normal operation.
6. Integral Visual-Indicating Light: LED type indicating detector has operated and power-on status.

#### B. Photoelectric Smoke Detectors:

1. Detector address shall be accessible from fire-alarm control unit and shall be able to identify the detector's location within the system and its sensitivity setting.
2. An operator at fire-alarm control unit, having the designated access level, shall be able to manually access the following for each detector:
  - a. Primary status.
  - b. Device type.
  - c. Present average value.
  - d. Present sensitivity selected.
  - e. Sensor range (normal, dirty, etc.).

#### C. Duct Smoke Detectors: Photoelectric type complying with UL 268A.

1. Detector address shall be accessible from fire-alarm control unit and shall be able to identify the detector's location within the system and its sensitivity setting.
2. An operator at fire-alarm control unit, having the designated access level, shall be able to manually access the following for each detector:
  - a. Primary status.
  - b. Device type.
  - c. Present average value.
  - d. Present sensitivity selected.
  - e. Sensor range (normal, dirty, etc.).

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3. Weatherproof Duct Housing Enclosure: NEMA 250, Type 4X; NRTL listed for use with the supplied detector.
4. Each sensor shall have multiple levels of detection sensitivity.
5. Sampling Tubes: Design and dimensions as recommended by manufacturer for specific duct size, air velocity, and installation conditions were applied.
6. Relay Fan Shutdown: Rated to interrupt fan motor-control circuit.

### 2.5 HEAT DETECTORS

- A. General Requirements for Heat Detectors: Comply with UL 521.
- B. Heat Detector, Combination Type: Actuated by either a fixed temperature of 135 deg F (57 deg C) or a rate of rise that exceeds 15 deg F (8 deg C) per minute unless otherwise indicated.
  1. Mounting: Twist-lock base interchangeable with smoke-detector bases.
  2. Integral Addressable Module: Arranged to communicate detector status (normal, alarm, or trouble) to fire-alarm control unit.

### 2.6 NOTIFICATION APPLIANCES

- A. General Requirements for Notification Appliances: Connected to notification appliance signal circuits, zoned as indicated, equipped for mounting as indicated and with screw terminals for system connections.
  1. Combination Devices: Factory-integrated audible and visible devices in a single-mounting assembly, equipped for mounting as indicated and with screw terminals for system connections.
- B. Horns: Electric-vibrating-polarized type, 24-V dc; with provision for housing the operating mechanism behind a grille. Comply with UL 464. Horns shall produce a sound-pressure level of 90 dBA, measured 10 feet (3 m) from the horn, using the coded signal prescribed in UL 464 test protocol.
- C. Visible Notification Appliances: Xenon strobe lights comply with UL 1971, with clear or nominal white polycarbonate lens mounted on an aluminum faceplate. The word "FIRE" is engraved in minimum 1-inch- (25-mm-) high letters on the lens.
  1. Rated Light Output:
    - a. 15/30/75/110 cd, selectable in the field.
  2. Mounting: Wall mounted unless otherwise indicated.
  3. For units with guards to prevent physical damage, light output ratings shall be determined with guards in place.
  4. Flashing shall be in a temporal pattern, synchronized with other units.
  5. Strobe Leads: Factory connected to screw terminals.
  6. Mounting Faceplate: Factory finished, red.

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### 2.7 REMOTE ANNUNCIATOR

- A. Description: Annunciator functions shall match those of fire-alarm control unit for alarm, supervisory, and trouble indications. Manual switching functions shall match those of fire-alarm control unit, including acknowledging, silencing, resetting, and testing.
  - 1. Mounting: Flush cabinet, NEMA 250, Type 1.
- B. Display Type and Functional Performance: Alphanumeric display and LED indicating lights shall match those of fire-alarm control unit. Provide controls to acknowledge, silence, reset, and test functions for alarm, supervisory, and trouble signals.

### 2.8 ADDRESSABLE INTERFACE DEVICE

- A. Description: Microelectronic monitor module, NRTL listed for use in providing a system address for alarm-initiating devices for wired applications with normally open contacts.
- B. Integral Relay: Capable of providing a direct signal to elevator controller to initiate elevator recall or operate Fire/Smoke damper.

### 2.9 DIGITAL ALARM COMMUNICATOR TRANSMITTER

- A. Digital alarm communicator transmitter shall be acceptable to the remote central station and shall comply with UL 632 and be listed and labeled by an NRTL.
- B. Functional Performance: Unit shall receive an alarm, supervisory, or trouble signal from fire-alarm control unit and automatically capture one telephone line and dial a preset number for a remote central station. When contact is made with central station, signals shall be transmitted. If service on line is interrupted for longer than 45 seconds, transmitter shall initiate a local trouble signal and transmit the signal indicating loss of telephone line to the remote alarm receiving station over the remaining line. Transmitter shall automatically report telephone service restoration to the central station. If service is lost on both telephone lines, transmitter shall initiate the local trouble signal.
- C. Local functions and display at the digital alarm communicator transmitter shall include the following:
  - 1. Verification that both telephone lines are available.
  - 2. Programming device.
  - 3. LED display.
  - 4. Manual test report function and manual transmission clear indication.
  - 5. Communications failure with the central station or fire-alarm control unit.
- D. Digital data transmission shall include the following:
  - 1. Address of the alarm-initiating device.
  - 2. Address of the supervisory signal.

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3. Address of the trouble-initiating device.
  4. Loss of ac supply or loss of power.
  5. Low battery.
  6. Abnormal test signal.
  7. Communication bus failure.
- E. Secondary Power: Integral rechargeable battery and automatic charger.
- F. Self-Test: Conducted automatically every 24 hours with report transmitted to central station.

### PART 3 - EXECUTION

#### 3.1 EQUIPMENT INSTALLATION

- A. Comply with NFPA 72 for installation of fire-alarm equipment.
- B. Install wall-mounted equipment, with tops of cabinets not more than 72 inches (1830 mm) above the finished floor.
- C. Duct Smoke Detectors: Comply with NFPA 72 and NFPA 90A. Install sampling tubes so they extend the full width of duct.
- D. Heat Detectors in Elevator Shafts: Coordinate temperature rating and location with sprinkler rating and location.
- E. Remote Status and Alarm Indicators: Install near each smoke detector and each sprinkler water-flow switch and valve-tamper switch that is not readily visible from normal viewing position.
- F. Audible Alarm-Indicating Devices: Install not less than 6 inches (150 mm) below the ceiling. Install bells and horns on flush-mounted back boxes with the device-operating mechanism concealed behind a grille.
- G. Device Location-Indicating Lights: Locate in public space near the device they monitor.

#### 3.2 CONNECTIONS

- A. For fire-protection systems related to doors in fire-rated walls and partitions and to doors in smoke partitions, comply with requirements in Section "Door Hardware." Connect hardware and devices to fire-alarm system.
1. Verify that hardware and devices are NRTL listed for use with fire-alarm system in this Section before making connections.
- B. Make addressable connections with a supervised interface device to the following devices and systems. Install the interface device less than 3 feet (1 m) from the device controlled. Make

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an addressable confirmation connection when such feedback is available at the device or system being controlled.

1. Alarm-initiating connection to elevator recall system and components.
2. Supervisory connections at valve supervisory switches.
3. Supervisory connections at elevator shunt trip breaker.

### 3.3 IDENTIFICATION

- A. Identify system components, wiring, cabling, and terminals. Comply with requirements for identification specified in Section 260553 "Identification for Electrical Systems."
- B. Install framed instructions in a location visible from fire-alarm control unit.

### 3.4 GROUNDING

- A. Ground fire-alarm control unit and associated circuits; comply with IEEE 1100. Install a ground wire from main service ground to fire-alarm control unit.

### 3.5 FIELD QUALITY CONTROL

- A. Tests and Inspections:
  1. Visual Inspection: Conduct visual inspection prior to testing.
    - a. Inspection shall be based on completed Record Drawings and system documentation that is required by NFPA 72 in its "Completion Documents, Preparation" Table in the "Documentation" Section of the "Fundamentals of Fire Alarm Systems" Chapter.
    - b. Comply with "Visual Inspection Frequencies" Table in the "Inspection" Section of the "Inspection, Testing and Maintenance" Chapter in NFPA 72; retain the "Initial/Reacceptance" column and list only the installed components.
  2. System Testing: Comply with "Test Methods" Table in the "Testing" Section of the "Inspection, Testing and Maintenance" Chapter in NFPA 72.
  3. Test audible appliances for the public operating mode according to manufacturer's written instructions. Perform the test using a portable sound-level meter complying with Type 2 requirements in ANSI S1.4.
  4. Test audible appliances for the private operating mode according to manufacturer's written instructions.
  5. Test visible appliances for the public operating mode according to manufacturer's written instructions.
  6. Factory-authorized service representative shall prepare the "Fire Alarm System Record of Completion" in the "Documentation" Section of the "Fundamentals of Fire Alarm Systems" Chapter in NFPA 72 and the "Inspection and Testing Form" in the "Records" Section of the "Inspection, Testing and Maintenance" Chapter in NFPA 72.

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- B. Reacceptance Testing: Perform reacceptance testing to verify the proper operation of added or replaced devices and appliances.
- C. Fire-alarm system will be considered defective if it does not pass tests and inspections.
- D. Prepare test and inspection reports.
- E. Maintenance Test and Inspection: Perform tests and inspections listed for weekly, monthly, quarterly, and semiannual periods. Use forms developed for initial tests and inspections.
- F. Annual Test and Inspection: One year after date of Substantial Completion, test fire-alarm system complying with visual and testing inspection requirements in NFPA 72. Use forms developed for initial tests and inspections.

END OF SECTION 283111